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Bothalia is vernoem ter ere van Generaal Louis Botha, eerste Eerste Minister en Minister van Landbou van die Unie van Suid-Afrika. Hierdie lyfblad van die Nasionale Botaniese Instituut, Pretoria, is gewy aan die bevordering van die wetenskap van plantkunde. Die hoofgebiede wat gedek word, is taksonomie, ekologie, anatomie en sitologie. Twee dele van die tydskrif en 'n indeks van die inhoud, outeurs en onderwerpe verskyn jaarliks.

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Kamiesbergia, a new monotypic genus of the Amaryllideae-Strumariinae (Amaryllidaceae) from the north-western Cape

D.A. SNIJMAN*

Keywords: Amaryllidaceae, Amaryllideae, new genus, north-western Cape, South Africa

ABSTRACT

Kamiesbergia Snijman is a new monotypic genus from raised granite outcrops in the north-western Cape. A member of the subtribe Strumariinae of the Amaryllideae, it is most closely related to *Hessea* Herb. and *Namaquanula* D. & U. Müller-Doblies. The dissimilar inner and outer stamens, the uniquely club-shaped inner filaments and the novel insertion of the filament in the proximal quarter of the anther connective are the main apomorphies of the genus. The number of rare and monotypic genera of Amaryllidaceae in this region is comparable to that of Andean South America.

UITTREKSEL

Kamiesbergia Snijman is 'n nuwe monotipiese genus van die hoërliggende granietriwwe in die Noordwes Kaap. Dit is 'n lid van die subtribus Strumariinae van die Amaryllideae en is die naaste verwant aan *Hessea* Herb. en *Namaquanula* D. & U. Müller-Doblies. Die verskille tussen die binneste en buitenste meeldrade, die unieke knuppelvormige binneste helmdrade en die ongewone aanhegting van die helmdraad aan die proksimale kwart van die helmbindsel is die hoofapomorfe van die genus. Die aantal skaars en monotipiese genusse van die Amaryllidaceae in hierdie streek kan vergelyk word met 'n soortgelyke verskynsel in die Andes-gebergtes van Suid-Amerika.

INTRODUCTION

The tribe Amaryllideae *sensu* Traub (1965, 1970) and Dahlgren *et al.* (1985) is uniquely defined by bisulculate pollen grains (Dahlgren & Clifford 1982; Dahlgren *et al.* 1985; Erdtman 1966; Schulze 1984). As presently circumscribed (Müller-Doblies 1985), the subtribe Strumariinae of the Amaryllideae currently includes four small and three monotypic genera (*Namaquanula* D. & U. Müller-Doblies, *Hessea* Herb., *Carpolyza* Salisb., *Strumaria* Jacq., *Bokkeveldia* D. & U. Müller-Doblies, *Gemmaria* Salisb. and *Tedingea* D. & U. Müller-Doblies). Character states common to these genera are the actinomorphic flowers and the reduced size of the plants. Exclusively southern African, the subtribe comprises approximately 35 species, which are concentrated in the semi-arid winter rainfall regions of the Cape Province and southern Namibia.

Phylogenetic studies in the Strumariinae (Snijman unpubl.), revealed an undescribed *Hessea*-like species from the north-western Cape. A character analysis confirmed the presence of bisulculate pollen grains but indicated that the taxon did not fit into any known genus of the Strumariinae. The new species lacks the synapomorphy of x = 10 and the adnation of the filaments to the style, which characterises *Carpolyza, Strumaria* and its close allies *Bokkeveldia, Gemmaria* and *Tedingea*; it lacks the centrifixed anther insertion which is synapomorphic for *Hessea*; and is without the adaxially-hooked filaments which characterise *Namaquanula*. Character states unique to the new taxon are the dissimilar inner and outer stamens, the club-shaped distal half of the inner filaments, and the filament attachment near to the base of the anther connective.

Since this new species lacks all the derived character states of the genera already described within the Strumariinae, and since it possesses a set of unique characters that justifies its separation at the generic level, the taxon is described here as the new monotypic genus *Kamiesbergia*.

MATERIALS AND METHODS

This study was based on herbarium material from BM, BOL, K, NBG, PRE, SAM and WIND. Ecological information was derived from field studies during the flowering, fruiting and leafing stages of the species. Fresh non-acetolyzed pollen grains for scanning electron microscopy (SEM) were dehydrated in ethanol, critical point dried and coated with Au/Pd. Photographs were taken with a Cambridge 200 SEM at 10 kv. Chromosome data were gathered from actively growing root tips, pretreated with saturated alphabromonapthalene at 4°C for 24 hours, then fixed in 1:3 acetic acid/ethanol. The root tips were hydrolysed in normal hydrochloric acid at 60°C for six minutes, stained with Feulgen for 30 minutes, counterstained with 2% aceto-orcein and then squashed. Photographs were taken with a Zeiss Axioskop.

Kamiesbergia stenosiphon *Snijman*, gen. nov. et sp. nov., ex affinitate generum *Namaquanula* D. & U. Müller-Doblies, *Hessea* Herb., *Strumaria* Jacq. sensu lato et *Carpolyza* Salisb. sed cum nullo genere satis congruit: ab *Carpolyza Strumariaque* absentia ullius commisurae inter stylum et filamenta recedit; ab *Namaquanula* absentia hamuli adaxialis filamentorum differt; ab *Hessea* absentia antherae centrifixae differt. Ab omnibus his generibus filamentis dissimillimis, filamentis interioribus claviformibus supra medium, antheris sub-basifixis differt.

TYPE.—Cape, 3018 (Kamiesberg): Kamiesberg, near Karas on E slopes of Rooiberg, (—AC), 28-4-1988, *Snijman 1175* (NBG, holo.; K, PRE).

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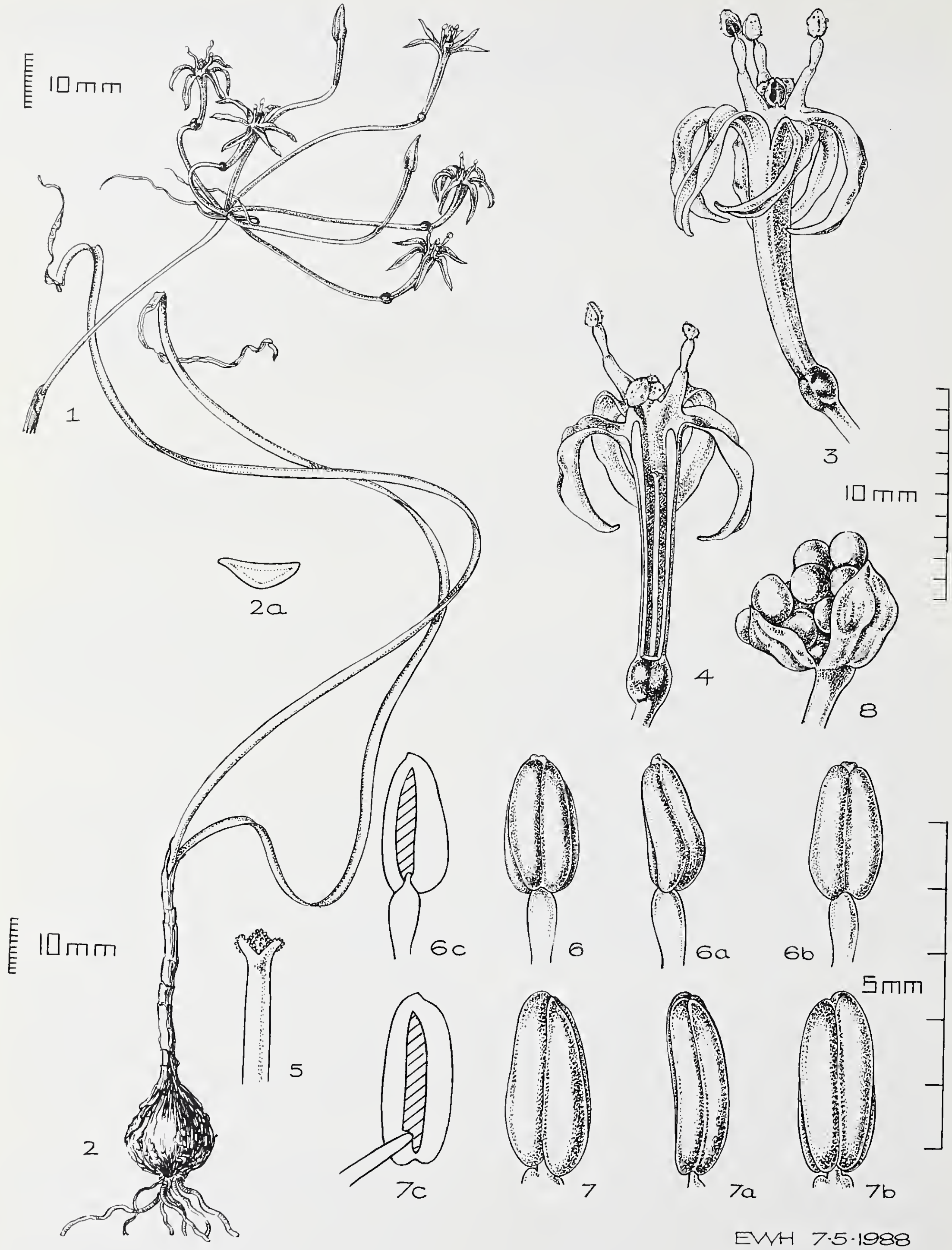

FIGURE 1.—*Kamiesbergia stenosiphon*. 1, inflorescence; 2, bulb and leaves; 2a, transverse section of leaf; 3, whole flower; 4, section of flower; 5, stigma; 6, anther attachment of inner stamens, ventral view; 6a, lateral view; 6b, dorsal view; 6c, section showing sub-basifixed insertion, connective hatched; 7, anther attachment of outer stamens, ventral view; 7a, lateral view; 7b, dorsal view; 7c, section showing sub-basifixed insertion, connective hatched; 8, capsule and seeds (drawn from *Snijman 1175*).

Bulbous perennial herb, up to 210 mm tall. *Bulb* solitary, deep-seated, subglobose, 12—30 mm across, with thin light-brown parchment-like outer tunics, fleshy and whitish within, extended into a long slender neck up to 110 mm. *Leaves* absent at anthesis or rarely persisting to anthesis, 2(—3), spreading, narrowly lorate, 60—300 × 1—3 mm, glabrous, with the adaxial surface shallowly canaliculate, subtended by a subterranean non-amplexicaul prophyll. *Inflorescence* slightly spreading, 40—80 mm across; scape stiffly erect, 50—140 mm long, 1—2 mm diam., greyish pink to leaden-grey, breaking off at the base in fruit; spathe valves linear-lanceolate, 15—30 × 1—2 mm; bracteoles filiform, up to 5 mm long. *Flowers* 5—9, ascending, hypocrateriform, pale lemon-yellow, usually with a greenish to reddish brown tube, flushed dorsally with reddish brown on the outer tepals, ageing to light brown, scentless; pedicels straight to upwardly curved, 35—60 mm long, green. *Tepals* recurving from a narrow 8—12 mm long tube, narrowly lanceolate, 6—8 × 2—3 mm, slightly channelled. *Stamens* in 2 unequal whorls, epitepalous, filaments basally connate into a greenish yellow tube extending to 0,5—1,0 mm above the perigone throat, free above, reduced to a 0,25 mm long filiform free tip in the outer whorl, prominent and spreading in the inner whorl; the inner filaments free for 3—4 mm, clavate in the distal half with a subulate tip; anthers dorsifixed near the base, ± 2,5 mm long and maroon before opening; the outer anthers occluding the perigone throat after dehiscence; pollen cream-coloured. *Ovary* subglobose, 2—3 mm across, with up to 4—6 ovules per locule. *Style* erect, slender throughout, up to 5—11 mm long, remaining included in the perigone tube; stigma shortly trifid, shortly penicillate on the inner surface. *Fruit* a subglobose, papery, loculicidal capsule, 7,5 mm across. Seeds fleshy, ovoid, up to 2,5 mm across, reddish brown when ripe. *Chromosome number*: 2n = 22. Figure 1.

Flowering time extends from the end of April to May. In most bulbs the foliage leaves commence growth shortly after flowering and subsequently die back at the onset of the summer drought. Occasionally some bulbs which occupy wetter, cooler sites have been noted with green leaves throughout the summer.

Diagnostic features of *K. stenosiphon* are the form of the stamens and anther insertion. The inner filaments are at least twelve times as long as the outer filaments and are uniquely club-shaped in the distal half with a subulate tip. The stamens of the short outer whorl occlude the perigone throat after dehiscence. Unlike the medifixed anthers common to all other Strumariinae, the filaments of *Kamiesbergia* are attached in the proximal quarter of the connective (Figure 1.6c & 1.7c).

The presence of a perigone tube is considered to be plesiomorphic in the subtribe (Müller-Doblies 1985). In most species of *Hessea* the perigone tube is reduced and the tubular component is formed by the extension of the perigone/stamen confluence into a winged tube, a feature which is considered to be derived (Müller-Doblies 1985). Only *H. longituba* D. & U. Müller-Doblies has a pronounced smooth perigone tube comparable to that of *K. stenosiphon*, which may suggest a close relationship between the two taxa. A critical evaluation of the key androecial states in *Hessea* and *K. stenosiphon* however, does not support such a relationship.

The main synapomorphy for *Hessea* is the insertion of the filament into a connective sheath, in which the length of the dorsal wall almost equals that of the ventral wall: a condition known as centrifixed anther insertion (Müller-Doblies 1985). This character state is interpreted as the extreme in a morphological series ranging from dorsifixed to subcentrifixed and centrifixed anther insertion, with each state being found in the Strumariinae. In contrast, a transformation series between the centrifixed anther insertion of *Hessea* and the almost basifixed anther insertion (without a connective sheath) of *K. stenosiphon* could not be established from current data. Thus a sister group relationship between the two genera cannot be inferred.

The bisulculate pollen grains are globose, isopolar and have scattered large spinulae on the surface (Figure 2). The karyotype of *K. stenosiphon* (Figure 3) comprises a pair of large submetacentric chromosomes; six pairs of medium-sized metacentric to submetacentric chromosomes, of which one pair is a satellite chromosome; and four pairs of shorter metacentric to submetacentric chromosomes. The chromosome phenotypes are similar to those of most Amaryllideae with x = 11 (Goldblatt 1972, 1976; Jones & Smith 1967). A karyotype of x = 11 is considered basic in the family (Inariyama 1937; Meerow 1984; Satô 1938).

Distribution and habitat records indicate that *K. stenosiphon* is rare. Known populations are restricted to the north-western Cape and are widely disjunct in the eastern Kamiesberg and near Pofadder (Figure 4). In the Kamiesberg, the deep-seated bulbs grow in loamy soils which accumulate in seasonally moist crevices and water-worn gullies on massive exposed granite domes, at

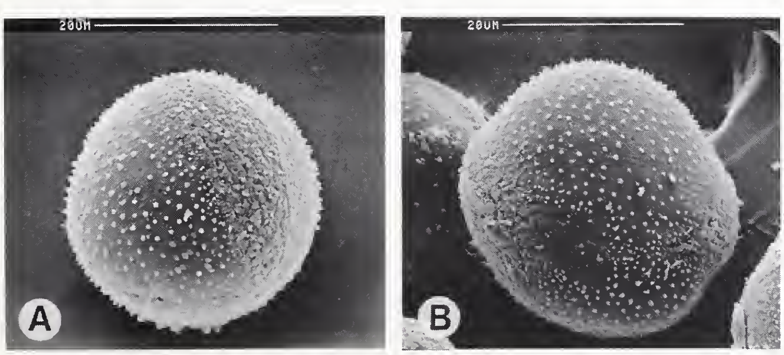

FIGURE 2.—Bisulculate pollen grains of *Kamiesbergia stenosiphon*, *Snijman 1175*. A, equatorial view, longitudinal position; B, equatorial view, transverse position. Scale bars = 20 μm.

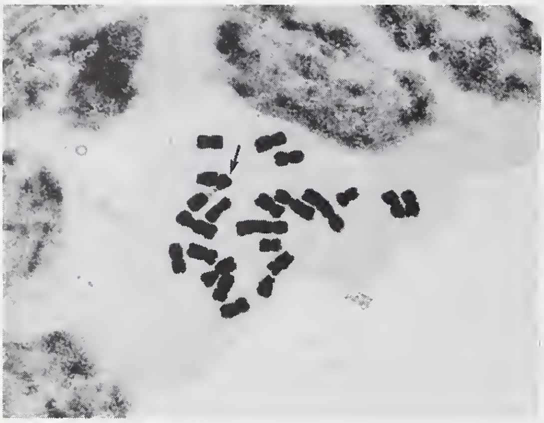

FIGURE 3.—Mitotic metaphase in *Kamiesbergia stenosiphon*, *Snijman 1175*, 2n = 22, × 665; the arrow indicates the satellite chromosome.

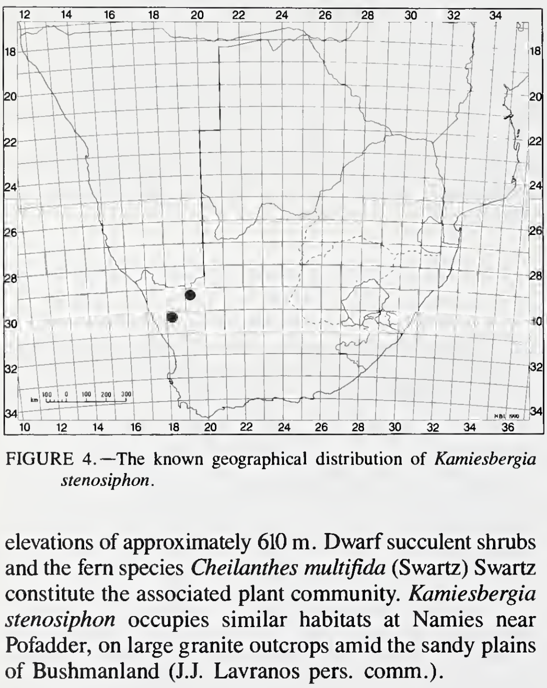

FIGURE 4.—The known geographical distribution of *Kamiesbergia stenosiphon*.

elevations of approximately 610 m. Dwarf succulent shrubs and the fern species *Cheilanthes multifida* (Swartz) Swartz constitute the associated plant community. *Kamiesbergia stenosiphon* occupies similar habitats at Namies near Pofadder, on large granite outcrops amid the sandy plains of Bushmanland (J.J. Lavranos pers. comm.).

Meerow (1987) has drawn attention to the number of small or rare monotypic genera amongst the pancratioid Amaryllidaceae in the northern Andean of South America. The discovery of *Kamiesbergia*, a further monotypic genus in the Amaryllideae, brings into focus the parallels which exist in this respect between the Amaryllideae of South Africa and the Andean Amaryllidaceae of South America. Goldblatt's suggestion (Meerow 1985) that similar evolutionary patterns exist between the Amaryllidaceae of these two geographical centres is yet to be examined.

CAPE.—2919 (Pofadder): Numis [Namies], near Pofadder, (–AC), *Lavranos 20311* (PRE). 3018 (Kamiesberg): Kamiesberg, near Karas on E slopes of Rooiberg, (–AC), *Snijman 1175* (K, NBG, PRE); near Karas on E slopes of Rooiberg, (–AC), *Snijman 1179* (NBG).

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Studies in the genus *Riccia* (Marchantiales) from southern Africa. 23. *R. bullosa*: typification and a full description

S.M. PEROLD*

Keywords: *Exormotheca bullosa, E. welwitschii*, Marchantiales, Portugal, *Riccia bullosa*, southern Africa, subgenus *Ricciella*, taxonomy

ABSTRACT

In the protologue of *Riccia bullosa*, Lindenberg (1829) based his vague and incomplete description of the taxon on two heterogeneous elements: a specimen from Portugal and one from the Cape. Stephani (1898) retained the name *Riccia bullosa* for the Cape element and referred the Portuguese plant to *Exormotheca welwitschii* (Stephani 1899). Although generally accepted until 1940, K. Müller (1940) rejected Stephani's segregation and referred the Portuguese element to his new combination, *Exormotheca bullosa* (Link) K. Müller, based on the false assumptions that Stephani had failed to recognize that the Portuguese plant was an *Exormotheca*, and that the Cape plant was insufficiently known and had not been found again. Counter arguments are set out here, urging a return to Stephani's earlier segregation. A lectotype for *Riccia bullosa* is selected, which results in the repudiation of Müller's (and Grolle's) lectotypification of *Exormotheca bullosa* (=*Riccia bullosa*).

UITTREKSEL

In die protoloog het Lindenberg (1829) sy vae en onvolledige beskrywing van *Riccia bullosa* op twee heterogene elemente gebaseer: 'n eksemplaar uit Portugal en een uit die Kaap. Stephani (1898) het die naam *Riccia bullosa* vir die Kaapse element behou en die Portugese plant na *Exormotheca welwitschii* (Stephani 1899) verwys. Alhoewel algemeen aanvaar tot 1940, het K. Müller (1940) Stephani se segregasie verwerp en die Portugese element verwys na sy nuwe kombinasie, *Exormotheca bullosa* (Link) K. Müller, op grond van die verkeerde aannames dat Stephani nie besef het nie dat die Portugese plant 'n *Exormotheca* is en dat daar te min oor die Kaapse plant bekend was en dit nie weer gevind is nie. Teenargumente ten gunste van die terugkeer na Stephani se vroeëre segregasie, word hier aangevoer. 'n Lektotipe vir *Riccia bullosa* word aangewys, met die gevolg dat Müller (en Grolle) se lektotipifisering van *Exormotheca bullosa* (=*Riccia bullosa*) verwerp word.

HISTORY AND TYPIFICATION OF *RICCIA BULLOSA*

Recently Dr R. Grolle (in litt.) drew my attention to nomenclatural problems concerning *Riccia bullosa* Link ex Lindenb., that have apparently not yet been satisfactorily resolved. This is due to Lindenberg (1829) having based his original species description on two heterogeneous elements: a specimen from Portugal, now referred to *Exormotheca* and a *Riccia* specimen from the Cape.

Lindenberg stated that he had received the Portuguese specimen under the manuscript name, *Riccia bullosa* Link, and the Cape specimen from Nees under the name *R. crassa*. The protologue (Lindenberg 1829) was incomplete and rather vague, and for the most part, it could apply to either plant.

In his *Monographie der Riccien*, Lindenberg (1836) gave an expanded description and drawings (Figure 1) of the entity which he referred to as *Riccia bullosa* Link. He still considered the Portuguese and the Cape specimens as both belonging to the same entity, even though he observed clear differences between them. He described the Portuguese plant as being less yellow and more lax and the layer of 'horizontal' cell tissue as being much thinner. He also mentioned that the Cape specimen had been collected by Ecklon. The illustrations of *R. bullosa* in Lindenberg (1836) depicts the Cape plant, as will be shown below.

Stephani (1898) took up the name *Riccia bullosa* for the Cape element and excluded the element from Portugal which in his opinion was clearly not a *Riccia*. At the time he was uncertain to which genus it belonged. He stated, however, that it matched a specimen collected in 1847 by Welwitsch (*Welwitsch 33*, see Mitten 1853) at Vendas on the banks of the Tejo River. In the following year Stephani (1899) referred the Portuguese plant to the genus *Exormotheca* and described it as *E. welwitschii* Steph., placing *Riccia bullosa* Link in Lindenb. ex parte in synonymy under it.

Stephani's interpretation of *R. bullosa* was generally accepted by South African authors, namely Sim (1926), Duthie & Garside (1937), as well as by the Swedish hepaticologist, Arnell (1963), who even cited Stephani as the author of this species, and also by myself (Perold 1989). Furthermore, Goebel (1905) in a footnote, had accepted *Exormotheca welwitschii* Steph. (*Riccia bullosa* Link) and so had K. Müller (1906—1911), although the latter admitted that he had not seen the original material at that time. Subsequently, however, K. Müller (1940) rejected Stephani's segregation on the basis that he, Stephani, had given the Portuguese plant a new name, because he had not recognized that *Riccia bullosa* was an *Exormotheca*, a statement which elicited from Schiffner (1942) the comment that Müller had done Stephani an injustice (ein Unrecht). Further evidence that Stephani had indeed known what he was about, is a postcard (xerox copy kindly sent to me by Dr C. Sérgio, LISU) which Stephani had written to Henriques on 13-2-1905, asking him, at Levier's suggestion, to please look for more material of the plant, *Exormotheca welwitschii*, which Welwitsch had collected more than 50 years before at Tejo. Stephani (1898) had clearly stated that Levier had assured him that this plant (i.e. Welwitsch's) was the authentic Portuguese *Riccia*

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Ms. received 1991-01.

bullosa. Incidentally, Levier's notes and drawings (no. 52907) of *Riccia bullosa* are housed at LISU and Sérgio (in litt.) has confirmed that they refer to *Exormotheca bullosa*. The three drawings (two of them are natural size) appear to be an almost exact copy of part of Lindenberg's (1836) illustration of *Riccia bullosa*, which actually is of the Cape *Riccia*, as will be shown below.

In 1940 Müller also published the new combination *Exormotheca bullosa* (Link) K. Müll., wrongly citing Link as author of the basionym. He placed *Riccia bullosa* Link and *Exormotheca welwitschii* Steph. (as well as *?E. holstii* Steph. and *Corbierella algeriensis* Douin & Trabut) in synonymy under it, thereby leaving the South African element without a correct name and thus failed to preserve current usage up to that time (see Recommendation 7B.5 of the I.C.B.N.). According to Müller's (1941) reasoning, Lindenberg (1829) had clearly indicated that the Portuguese element represented the only authentic and original material, because Lindenberg had cited Link (who had brought this specimen from Portugal) as the author and had also adopted Link's epithet, namely *Riccia bullosa*. In addition, Müller argued that Link had not even known about the Cape plant. In Müller's view, he was acting in accordance with the author's (i.e. Lindenberg's) intent. Furthermore, in his opinion Lindenberg's description of the Link species was wrongly expanded by his inclusion of the Cape species and, of even greater importance to Müller, he thought that the drawing of the thallus in cross section, on Table 23, Figure 1.6 (Lindenberg 1836) reproduced here as Figure 1, left no doubt at all that *Riccia bullosa* was identical with *Exormotheca welwitschii*. By his use of the words 'authentic' and 'original' for Link's Portuguese element, Müller (1940) effectively lectotypified *Riccia bullosa* (see Recommendation 7B.4 of the I.C.B.N.). This was accepted and followed by Grolle (1976), who specifically cited the Lindenberg Herbarium No. *9037* as the lectotype.

In considering the various arguments put forward by Müller (1940, 1941, 1947, 1951–1958) in support of his conclusions, Lindenberg's (1829) protologue must be examined first. The fact that Lindenberg cited Link as the author and adopted Link's name for the species are not significant nomenclatural issues, since Link had not validly published the name or a description of the plant; it was merely a manuscript name, as was Nees's name of *R. crassa* for the Cape plant that Lindenberg also referred to in the same description. The two references in this protologue (at the beginning and again at the end) to a groove, in my opinion clearly point to the Cape *Riccia* which, especially in dried material, is distinctly grooved medianly. Stephani (1898) described it as 'profunde sulcata', whereas *Exormotheca* is less obviously so, and except for *E. tuberifera* Kash. (Schiffner 1942), members of this genus are not reported elsewhere in the literature as being grooved.

For the following reasons I also do not agree with Müller that Lindenberg's (1836) drawings are those of an *Exormotheca*: a narrow, deep dorsal groove is clearly shown from above as well as in the transverse section of the thallus; there are no assimilation filaments arising from the base of the air chambers; no stomata are drawn in Lindenberg's figures (Figure 1.5, 1.7 & 1.8) and in fact, in his more detailed description, Lindenberg (1836) stated that openings or pores are absent. Schiffner (1942) also remarked that stomata are absent, which is not strictly correct, but such an observation could never apply to *Exormotheca*, a genus in which stomata are very obvious. Ventral scales, another striking character of *Exormotheca*, are also not illustrated by Lindenberg (1836) and finally, about twice as many air chambers are shown across the width of the thallus in the cross section, as the six (or so) that Müller described for *Exormotheca*. Müller (1947), however, was so confident that Lindenberg's cross section illustrated an *Exormotheca* that he accused Schiffner of remaining silent about it, when Schiffner (1942) had clearly stated that the description and illustration referred to the Cape *Riccia* only. Schiffner's (1942) own drawings of Link's specimen from Portugal (Herb. Lindenberg No. *9037*) (Figure 5a, b, c) are obviously those of an *Exormotheca* with triangular scales and with tall air chambers which contain assimilation filaments at the base. Müller (1947) admitted to not having seen the Cape plant, because he could not locate the specimens in Lindenberg's herbarium in Vienna, or at the herbarium of the Botanical Museum in Berlin. He concluded that they must have been with Schiffner in Vienna. In Müller's (1947) opinion, the 'ziemlich ungeklärte *Riccia* vom Kap' was not found again, and because he regarded it as a dubious species, it should get another name! None of these arguments, forwarded by Müller to justify his actions, are correct.

Schiffner had by 1942 decided that *Exormotheca bullosa* (Link) K. Müll. nov. comb. should be withdrawn as a species, 'als Art einzuziehen', and he referred to the Portuguese plant as *Exormotheca welwitschii*. Müller, however, (1947, 1951–1958) continued to defend his point of view. In passing, it could perhaps be mentioned that both Schiffner (1862–1944) and Müller (1881–1955) were engaged in studying and describing *Exormotheca* species at about the same time and there may have been a measure of competition between them.

To summarise: judging from Lindenberg's (1829) reference to a 'grooved' plant, as well as his drawings and expanded description (Lindenberg 1836), he was referring to the Cape plant, even though he had credited Link as the author and had adopted Link's unpublished name for the species. These are, however, without nomenclatural significance, as remarked upon before.

Article 8.1 of the I.C.B.N. states that: the author who first designates a lectotype must be followed (in this case Müller), but his choice is superseded if various conditions are not met:

(b) if it can be shown that it is in serious conflict with the protologue and another element is available which is not in conflict with the protologue (the Cape element is 'grooved', whereas Link's is not, but otherwise the description is vague, and one may hesitate to invoke the term 'in serious conflict with....');

(c) if it was based on a largely mechanical method of selection (Müller could not locate the Cape element and only the Link element was available to him, which can be interpreted as a 'largely mechanical method of selection');

(d) if it is contrary to Article 9.2, which states 'if it is proved that such a type herbarium sheet or preparation contains parts belonging to more than one taxon, the name must remain attached to the part (lectotype) which corresponds most nearly with the original description' (in this case 'grooved').

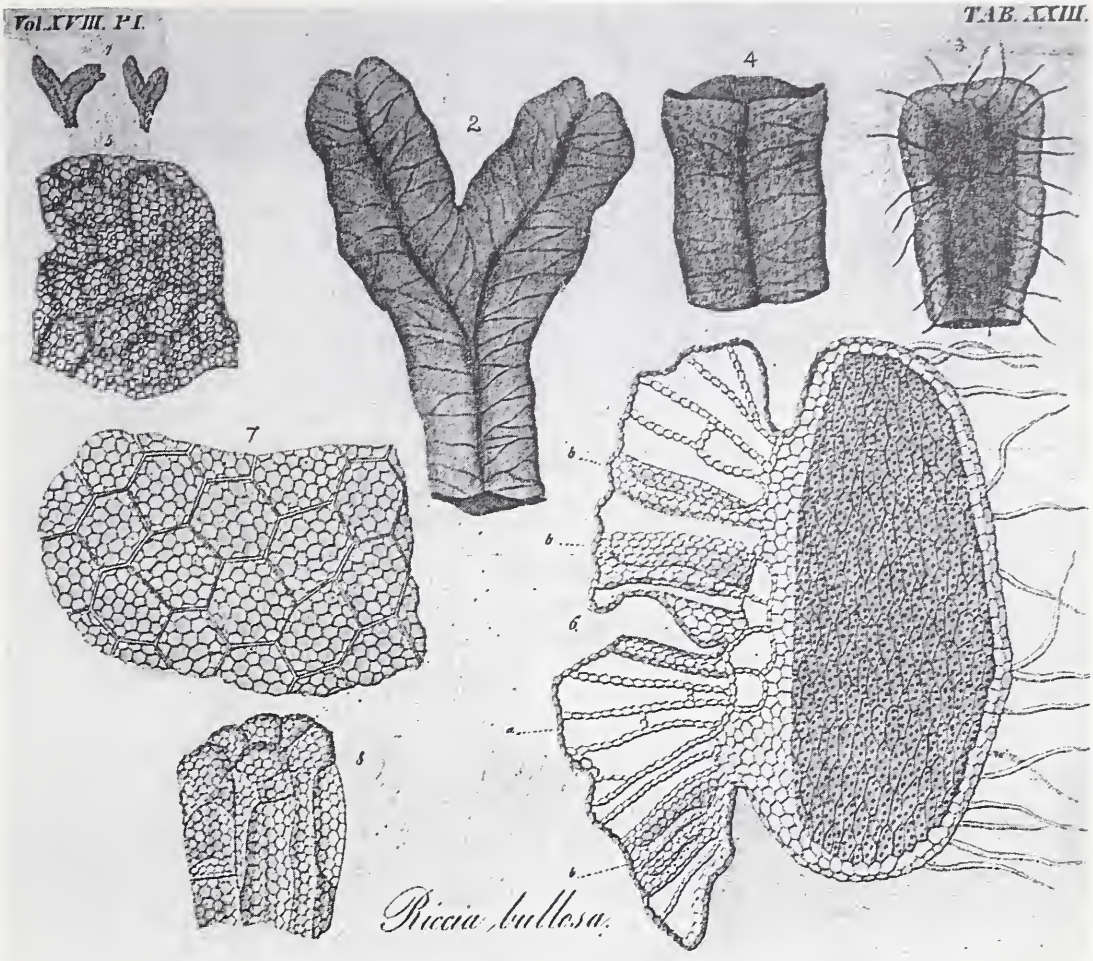

FIGURE 1.—Reproduction of TAB. XXIII. Fig. 1. Vol. XVIII PI *Monographie der Riccien* by J.B.G. Lindenberg, p. 443. Captions translated into English: 1.1, *Riccia bullosa*, natural size; 1.2, enlarged. The walls of the air chambers appear as veins on the surface; 1.3, a piece of the thallus, enlarged, from below; 1.4, a piece of the thallus, much enlarged, so that the texture together with the transparent air bladders are visible; 1.5, a piece of the thallus, even more enlarged; 1.6, transverse section: a.a. the air canals; b.b. the same with side walls; 1.7, a piece of the epidermis, much enlarged; 1.8, some air canals, of which some are divided by a cross wall.

Müller's manner of selecting the lectotype was largely mechanical, which would be the most decisive reason for not following him.

Müller's (1940) comb. nov. and his and Grolle's (1976) lectotypification are therefore superseded here and it is proposed that the nomenclature should revert to that of Stephani.

Riccia bullosa *Link MS ex Lindenb.* in Nova Acta Academiae Caesareae Leopoldino Germanicae Naturae Curiosorum 14 (Supplement): 119 (1829); Lehm.: 371 (1829); Lindenb.: 441 (1836); Nees: 391, 433 (1838); Gott. *et al.*: 609 (1844–1847); Steph.: 377 (1898); Sim: 13 (1926); S. Arnell: 42 (1963).

TYPE.—Promontorio Cap, terrestris, ad montem tabularem versus montem Leonio *sine coll. et no.* (STR!, selected here as lecto.)

R. crassa Nees ex Lindenb. in Nova Acta Academiae Caesareae Leopoldino Carolinae Germanicae Naturae Curiosorum 14 (Supplement): 119 (1829) nom. inval.

R. montaguensis S. Arnell in Botaniska Notiser 105: 308 (1952); S. Arnell: 44 (1963). Types: Cape Province, Montagu, Bath Kloof, near the caves, *S. Arnell 714* (BOL!, PRE!), *741* (BOL!).

Thallus dioicous (Figure 2A,B), ?perennial, in crowded, gregarious patches or scattered (Figure 3A); apically light green, soon turning straw-coloured, deeply grooved, laterally swollen to bloated, with small, polygonal, domed areas, becoming proximally pitted and spongy; when dry, rather deflated and with folds across, sides not inflexed, margins scalloped; branches once, occasionally twice dichotomously furcate, sometimes simple, shortly to deeply divided, moderately to widely divergent; broadly ovate to oblong, 5,0–15,0 × 3,5–5,5 mm, 1,5–2,5 mm thick, in section 2,0–2,5 times wider than thick; apex obtuse to truncate, emarginate. Groove deep and narrow, sometimes split into two by raised wedge of tissue (Figure 3B), disappearing toward base or at sporangia. Thallus margins obtuse, rounded, often overhanging. Flanks sloping obliquely, ventral face rounded to keeled, green. Scales hyaline, vestigial (Figure 3C), in pairs, ventral, toward apex only.

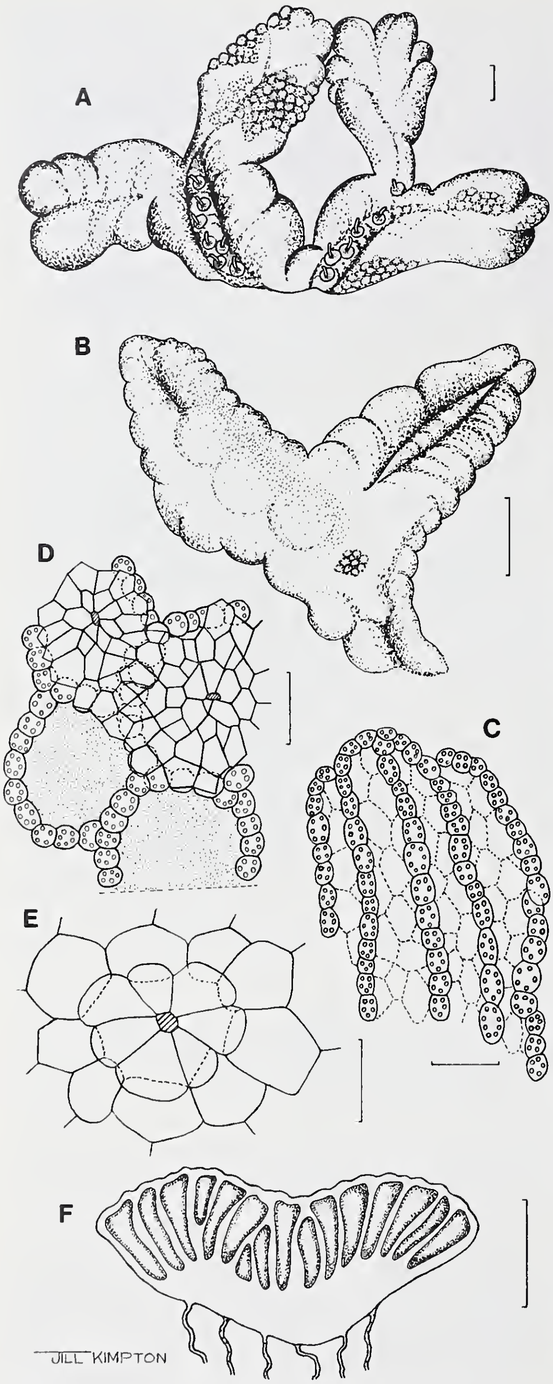

FIGURE 2.—*Riccia bullosa*. A, male thallus; B, female thallus; C, cross section of epidermis and assimilation tissue; D, epidermal cells and air pores (hatched) overlying air chambers, the latter exposed (and stippled) below; E, air pore (hatched) and surrounding cells as seen from above; F, cross section of branch. A, B, *S.M. Perold 467*; C–F, *Van Rooy 3541*. Scale bars on A, B, F = 1 mm; C, D = 100 μm; E = 50 μm.

Anatomy of thallus: dorsal epidermis forming a domed roof over each air chamber (Figure 2C), cells 4–6-sided, 62–75 × 35–40 μm, air pores ringed by 6 or 7 wedge-shaped cells, smaller (Figures 2D, E; 3B) and often thinner-walled, 37 × 17 μm, breaking down with age and exposing air chambers; assimilation tissue 1000–1500 μm thick, occupying 3/5 of thickness of thallus, air chambers tall, mostly in one layer, vertical medianly and sloping obliquely toward margins (Figure 2F), 175–250 μm wide, narrower toward centre and apex, separated by chlorophyllose plates, one cell thick; storage tissue 2/5 the thickness of thallus, cells angular, closely packed, 65–75 μm wide, containing starch granules. *Antheridia* in one or two crowded rows along slightly raised central ridge in groove, hyaline necks protruding from small pits, up to 500 μm long. *Archegonia* in a row along groove, purple necks ± 300 μm long. Sporangia ± 1100 μm wide (Figure 2B), crowded together, bulging dorsally, overlying tissue thinning and disintegrating, containing ± 700 spores each. *Spores* (100–)130–150(–160) μm in diameter, triangular-globular, polar, yellow-brown, becoming darker with age, semitransparent; wing thin, undulating, up to 10 μm wide, often perforated at marginal angles, margin finely crenulate, occasionally partly erose; ornamentation reticulate, rather similar on two spore faces: distal face (Figure 3E) with 10–12 rounded areolae across diameter, 10–15 μm wide, sometimes larger and incompletely separated by low, fragmentary ridges radiating from central pillar, areolar walls finely granular, ± 5 μm high, thin, generally becoming higher and thicker over centre, raised at nodes and often extending onto wing; proximal face (Figure 3F) with triradiate mark consisting of thin ridges up to 7,5 μm high, frequently joined by areolar walls, each of three facets with (13–)18(–25) rounded areolae, 10–15 μm wide, often incompletely separated and adjoining ones confluent. *Chromosome number*: n=8 (Bornefeld 1989).

Riccia bullosa is endemic to southern Africa and is found at seepages or on damp sandy soil underneath brush, or at granitic, basaltic or sandstone outcrops in the western and southern Cape and in the subalpine belt of the Drakensberg Mountain range of Natal and Lesotho in grasslands or bogs (Figure 4). It is placed in the subgenus *Ricciella* and can be distinguished from related species, *R. garsidei* and *R. volkii*, by its straw-coloured or yellowish green, rather swollen thalli. *R. garsidei* Sim is often larger, almost white when dry, with many exposed air chambers; its spores have fewer and larger areolae. *R. volkii* is less robust and not so bloated, with narrowly winged, smaller spores and its distribution is restricted to the summer rainfall areas.

Arnell (1963) regarded *R. bullosa* as intermediate between *(Eu-) Riccia* and *Ricciella* with its narrow air spaces in the median part of the thallus and wide air chambers in the lateral parts. This is rather similar to Stephani's (1898) interpretation of *R. vesiculosa* Carr. & P. from Australia, which prevented him from dividing the genus *Riccia* into two subgenera, but as Na-Thalang (1980) and Volk (1983) have shown, it is not correct to separate these two subgenera on the size of the air chambers; the anatomy of the air chambers, the pores and the arrangement of the epidermal cells should be considered to be of greater importance.

Arnell (1952) described a new species, *R. montaguensis*, admitting that it was very similar to *R. bullosa* in habit and colour, although somewhat smaller. The supposedly smaller spores, which he reported to be 80 μm in diameter, were found to be rather larger at 100–130 μm (refer also

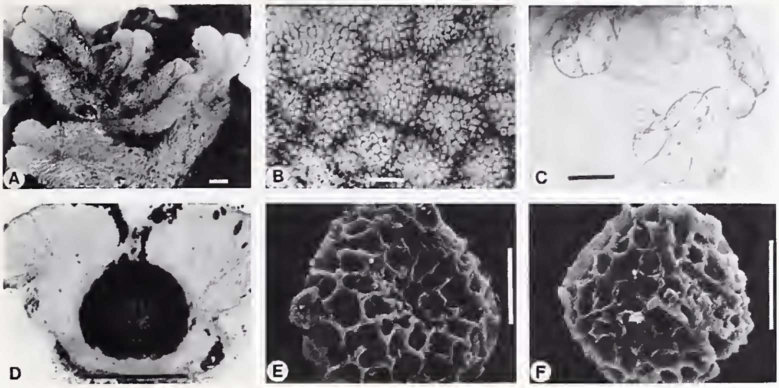

FIGURE 3.—*Riccia bullosa*. A, living thalli; B, dorsal epidermal cells from above, air pores hardly visible; C, vestigial ventral scales; D, cross section through thallus and sporangium; E, distal face of spore; F, proximal face of spore. A, *Jean Thompson 278*; B, D, *Oliver 8038*; C, *Van Rooy 3541*; E, F, *Riccia crassa* Nees (STR). Scale bars on A, D = 1 mm; B ± 200 μm; C, E, F = 50 μm.

Garside's note on the herbarium sheet of specimen *S. Arnell 714* (BOL)). The ornamentation on the distal face is incomplete, with some large areolae containing a central papilla and low, radiating ridges (Perold 1989).

Specimens of *R. montaguensis* were closely examined and found to be indistinguishable from *R. bullosa*, which can vary considerably in size from rather small to large. Spores from all the sporulating material of this species at BOL and the many recent collections at PRE have been measured and photographed and they exhibit a continual gradation in size and also in the completeness or incompleteness of the ornamentation, so that a broader circumscription of *R. bullosa*, which includes these variations, is necessary. *R. montaguensis* S. Arnell is therefore included in the synonymy of *R. bullosa*.

Sim's (1926) description of *R. bullosa* is quite clear and it will be noticed that he refers to the central channel as very pronounced but narrow, that ventral scales are absent, that there are about 12 'air cavities' on each side of the central channel and that the air pores are minute, but with age the air cavities are left open at the top. The spore diameter should, however, be 170 μm and not 17 μm, clearly a conversion error.

Sim's observation that *R. capensis* (Brunnthaler 1913) appears to be a young sterile condition of this, is inexplicable, as they are completely different species: *R. capensis* has been placed in synonymy under *R. limbata* (Perold & Volk 1988). The Giffen collection (ex Herb. Sim) from 'Ookiep', Namaqualand, which Sim cites, has been referred to *R. schelpei* Volk & Perold (1986), but the Pole Evans collection from Premier Mine, Transvaal, has not been traced. It is most probably a specimen of *R. volkii*, judging by the distribution of this species.

Close examination of Nees's material, now held at STR, shows that the contents of the two packets labelled *Riccia crassa* are indeed *R. bullosa*. One of these two specimens is a single thallus containing a sporangium with ripe spores (Figure 3E, F). The other specimen is here selected as lectotype because it agrees well with the protologue, its locality is clearly stated and it is reasonably good material; the specimen is identified on the label and in the protologue as *R. crassa*, but no collector's name is given. It must have been Ecklon, however, (Lehmann 1829), as also cited by Stephani (1898). The latter's three herbarium specimens at G were seen, and these are most probably duplicates. They had been identified as *R. bullosa* and no mention is made of *R. crassa*. For this reason none of these specimens were selected as lectotype. The contents of a third packet, labelled *R. bullosa*, cannot be identified. The packet labelled *R. ecklonii* c. tr. *R. bullosa*, appears to contain a male plant of *R. purpurascens* Lehm. This is also inferred from Nees's (1838) description, where it is added in a footnote that the male plant he described was from 'Vorgebirge der guten Hoffnung', meaning the Cape of Good Hope, but the word, Cape, was left out [as Lindenberg (1836) also did]. Nees (1838) also described the antheridia causing bulging of the frond above and below. The bulges below were, according to him, richly supplied with rhizoids and therefore resembled sporangia of *R. natans* (= *Ricciocarpos natans* (see Perold 1990, Figure 6F). Such dorsiventral swellings are quite conceivable in the thin thallus of *R. purpurascens* but hardly in a thallus as thick as that of *R. bullosa*.

Typification of *Exormotheca welwitschii* Steph.

TYPE.—Portugal, Vendas am Tejo, *Welwitsch s.n.* (but no. *33* fide Mitten 1853) (BM, LISU, G!) fide Stephani 1899, Species hepaticarum, Bulletin de l'Herbier Boissier 7: 220. *Riccia bullosa* auct. non Link ex Lindenberg 1829; Müller 1940, Rabenhorst's Kryptogamen Flora von Deutschland und der Schweiz 6 (Ergänzungsband): 278–280.

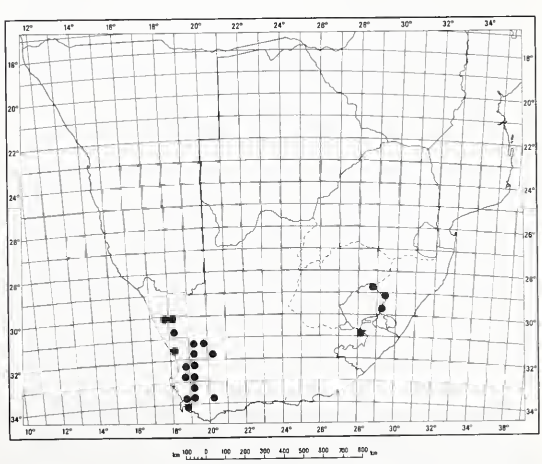

FIGURE 4.—Distribution of *Riccia bullosa* in southern Africa.

SPECIMENS EXAMINED

O.F.S.—2828 (Bethlehem): Witzieshoek, Drakensberg, at base of Sentinel, (—DA), *Schelpe 7690* (BOL, PRE); Drakensberg, Sentinel Pass, (—DB), *Oliver 7324* (PRE); Wintershoek, Sentinel, footpath, (—DD), *Jean Thompson 277, 278* (PRE); Sentinel, along path from parking area to chain ladder, (—DD), *Van Rooy 1086* (PRE).

NATAL.—2828 (Bethlehem): Mont-aux-Sources, Drakensberg, (—DD), *Schelpe 23856* (BOL); Mont-aux-Sources, (—DD), *Ellis CH13474* (PRE). 2929 (Underberg): Bergville, Drakensberg, Injasuti area, (—AB), *Esterhuysen 26141* (BOL).

LESOTHO.—2828 (Bethlehem): Oxbow, 2 km W of Lodge, (—DC), *Magill 4588* (PRE); Mahlasela Hill (West), 10 km from New Oxbow Lodge to Mokhotlong, (—DC), *Van Rooy 2995* (PRE); 4 km from New Oxbow Lodge to Butha Buthe, (—DC), *Van Rooy 3133, 3135, 3136, 3142* (PRE). 2929 (Underberg): Sani River, circa 7 km from Sani Top to Mokhotlong, (—CA), *Van Rooy 3462* (PRE); Sani Pass, marsh flats with scattered rock outcrops N of mountain lodge, (—CB), *Magill 4401A* (PRE); south of Sani Pass on Border Post, (—CB), *Magill CH4509* (PRE); Sani Top, at disused air strip, N of mountain chalet, (—CB), *S.M. Perold 2523* (PRE); Sani Top, south side of dam, near border post, in ditch, (—CB), *S.M. Perold 2527, 2528A* (PRE); Sani Top, along upper Sani Valley, N of border post, (—CB), *Van Rooy 3535* (PRE); Sani Top, mountain slopes W of border post, (—CB), *Van Rooy 3541, 3578, 3579* (PRE); Sehlabathebe Nat. Park, (—CC), *Magill 4317* (PRE).

CAPE.—3017(Hondeklipbaai): Kamiesberg Pass, circa 5 km from Kamieskroon, (—BB), *S.M. Perold 1600* (PRE). 3018 (Kamiesberg): 5,2 km along Rooifontein turn-off from Kamieskroon-Leliefontein road, (—AA), *S.M. Perold 1471, 2170* (PRE); Farm Welkom, N of Leliefontein, Rooiberg Peak, (—AC), *Ellis CH 13467* (PRE); Kamiesberg, plateau N of Leliefontein towards Draaiklip, (—AC), *Oliver 8038* (PRE); Studer's Pass, 8 km from foot of pass, on road to Garies, (—AC), *S.M. Perold 1615* (PRE); on road between Kamieskroon and Leliefontein, 5 km before Leliefontein, (—AC), *S.M. Perold 2097* (PRE); southern Kamiesberg, Klippoort SE of Hoedberg, (—CB), *Oliver 9555* (PRE). 3028 (Matatiele): Barkly East, Naude's Nek, (—CC), *Jean Thompson 266, 267* (PRE). 3118 (Van Rhynsdorp): Olifants River Valley, between Klawer and Citrusdal, (—CA), *Wilman 663* (BOL). 3119 (Calvinia): Nieuwoudtville-Calvinia road, 7 km along Rondekop turnoff, (—AC), *S.M. Perold 2320* (PRE); Calvinia, Hantamsberg, main plateau, south end, (—BD), *Oliver 8876* (PRE); Hantamsberg, Farm Van Rhynshoek, NE of Calvinia, near FM tower, (—BD), *S.M. Perold 1821, 2335* (PRE); Botterkloof Pass, Farm Daantjie se Kraal, 37 km along road between Soetwater and Clanwilliam, (—CB), *S.M. Perold 1872, 1874* (PRE). 3120 (Williston): N Roggeveld, Knegtsbank, (—CC), *Oliver 8926* (PRE). 3218 (Clanwilliam): 16 km E of Clanwilliam, along Pakhuis Pass, (—BB), *S.M. Perold 1919, 1924* (PRE); 20—23 km N of Citrusdal, near Olifants River, (—BD), *S.M. Perold 536, 2388, 2396* (PRE); Farm Middelpos, on road from Goedverwag, NW of Piketberg, (—DC), *S.M. Perold 510* (PRE). 3219 (Wuppertal): on road between Soetwater & Clanwilliam, 3 km before turnoff to Biedouw/Wupperthal, (—AA), *S.M. Perold 1881* (PRE); Biedouw Youth Camp, 19 km along road to Wupperthal, (—AA), *S.M. Perold 1897* (PRE); 30 km E of Clanwilliam beyond Pakhuis Pass, (—AA), *S.M. Perold 1945* (PRE); Biedouw Valley, Farm Mertenhof, Bushman Cave on slope facing west, (—AB), *Oliver 1466* (BOL); Cedarberg Pass, at end of pass, before entering Perdekloof, (—AC), *S.M. Perold 555* (PRE); between Sneeuberg and Cedarberg, (—AC), *S.M. Perold 562* (PRE); 46 km from Berg-en-dal to Clanwilliam, via Cedarberg, (—AC), *Stirton 9175* (PRE); Farm Kleinplaas, 17 km from Citrusdal on road to Ceres, (—CA), *S.M. Perold 2400* (PRE); 55 km from Ceres, along road to Op-die-Berg, (—CD), *Koekemoer 319* (PRE). 3318 (Cape Town): Stellenbosch, (—DD), *Duthie CH 1055* (PRE); Stellenbosch, between Union Park and Marais Park, (—DD), *Duthie s.n.*, 2-12-1936 (BOL); Stellenbosch, (—DD), *Duthie s.n.*, 20-9-1937 (BOL); *Duthie s.n.*, 10-1937 (BOL); Stellenbosch, Platklip, (—DD), *Duthie 5486a* (with *R. compacta*) (BOL); Stellenbosch flats, (—DD), *Garside 2, 3* (PRE); Stellenbosch, Platklip, near Municipal dumping ground, (—DD), *Morley 215* (PRE), *S.M. Perold 467* (PRE). 3319 (Worcester): Tulbagh, just NE of Saronsberg, (—AA), *Oliver 1475* (BOL; PRE); Op-die-Berg, near Dutch Reformed Church, (—AD), *Morley 272* (PRE), *S.M. Perold 566, 2401* (PRE); Ceres end of Baineskloof, (—CA), *Oliver 1476* (BOL; PRE); on road between Franschhoek and Paarl, (—CC), *Morley 306* (PRE). 3320 (Montagu): Montagu, (—CC), *S. Arnell 741* (BOL); (type specimen of *R. montaguensis* S. Arnell). 3324 (Steytlerville): on road between Patensie and Willowmore, (—CA), *Koekemoer 284* (PRE). 3418 (Simonstown): Harmony Strand, NW of Gordon's Bay, (—BB), *Oliver 8777* (PRE).

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Studies in the Ericoideae (Ericaceae). VIII. New species in *Erica*, section *Pseuderemia*, from southern Africa

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Keywords: *Erica*, new species, southern Africa, taxonomy

ABSTRACT

Three new species are described in the genus *Erica* L.: *E.* **abbottii** E.G.H. Oliver, endemic to the South Coast of Natal and neighbouring Transkei, *E.* **swaziensis** E.G.H. Oliver, a Swaziland endemic, and *E.* **ingeana** E.G.H. Oliver which is confined to the high mountains in the eastern Little Karoo of the Cape Province.

UITTREKSEL

Drie nuwe spesies in die genus *Erica* L. word beskryf: *E.* **abbottii** E.G.H. Oliver, endemies tot die Suidkus van Natal en aangrensende Transkei, *E.* **swaziensis** E.G.H. Oliver, endemies tot Swaziland, en *E.* **ingeana** E.G.H. Oliver met 'n beperkte verspreiding op die hoë berge in die oostelike Klein Karoo van die Kaapprovinsie.

INTRODUCTION

Studies in Section *Pseuderemia* of the genus *Erica* L. prompted by the recent discovery of a new species from the Natal South Coast, have brought to light several distinct new species, which had hitherto remained undescribed. This research also revealed problems in a number of species complexes as well as in the delimitation of the section and its position in the genus.

Section *Pseuderemia* was created by Bentham (1839) and upheld by Guthrie & Bolus in their treatment of the genus for *Flora capensis* (1905). In it were placed those species with small, corolline flowers aggregated into head-like inflorescences placed at the ends of main branches and lateral branchlets, the flowers having the stamens included. The delimitation of sections within the genus *Erica* has up to now provided a reasonably useful framework for the identification of species, but has also led to many problems due to the artificiality of the sections. In the case of Section *Pseuderemia* there are indications that species placed in several other sections, such as Sections *Ceramia, Ephebus, Pachysa, Orophanes* and even Section *Dasyanthes* with its long-tubed flowers, could have a closer relationship to species in Section *Pseuderemia* than to species in their own sections. This problem can only be dealt with satisfactorily after an assessment of the whole genus at subgeneric level. The three new species are therefore described below within the section as currently construed.

The section contains some 18 species including the three new species described below and is distributed widely throughout the southern half of the African continent. Among the earlier described species, *E. johnstoniana* Britten is found in Malawi, Mozambique and Zimbabwe, *E. holtii* Schweick. in the eastern Transvaal, *E. reenensis* Zahlbr. in the Natal Drakensberg, and the complex of *E. cooperi* H. Bol./*E. baurii* H. Bol. in Natal and the Transkei at lower altitudes. The remaining eight species occur in the south-western Cape Province. *E. solandra* Andr. is confined to the Outeniqua Mountains. The complex of *E. sphaerocephala* Wendl. ex Benth./*E. maderi* Guth. & Bol./*E. oxysepala* Guth. & Bol. is common in the Ceres to Clanwilliam Districts and exhibits much variation over both geographical as well as altitudinal ranges. *E. cernua* C.V. Montin and *E. pudens* H.A. Baker are both western Cape species found from Ceres northwards as far as Namaqualand (*E. pudens*). The other four species are very localized: *E. clavisepala* Guth. & Bol. in the southern Cape Peninsula; *E. acockii* Compton, known only from near Bellville and now extinct; *E. orculiflora* Dulfer from the mountains just south of Ceres; and the very distinct *E. greyii* Guth. & Bol., recorded only as a single collection from an unspecified locality in the Cold Bokkeveld in 1860.

Erica abbottii *E.G.H. Oliver*, sp. nov., in sectione *Pseuderemia*, habitu laxo prostrato, corolla alba, antheris luteolis, ovario pilis stellatis tecto, ovulis 4 ad 6 in quoque loculo dignoscenda.

Fruticulus sparsus debilis effusus ad 600 mm diametro, pubescens et pilis dispersis longis glandulosis tectus, glandibus rubentibus. *Rami* tenues filo metallico similes. *Folia* 4-nata patentia, 2,5 mm longa, oblonga, acuta. *Flores* 4–9 in capitis ad extrema ramorum ramulorumque, pedicello 1,0–2,5 mm longo; bractea mediana usque subapproximata, foliacea, 2,5–3,5 mm longa lineari-lanceolata; bracteolis 2 approximatis, subfoliaceis, lineari-lanceolata. *Calyx* 4-partitus, 2,5–3,8 mm longus, anguste oblongus. *Corolla* 4-lobata, 3–5 mm longa, obovoideo-urceolata vel obconica, pubescens, alba, lobis erectis papillatis. *Stamina* 8, libera inclusa; filamentis linearibus, apice sigmoideis, glabris; antheris subbasalibus, 0,8–1,3 mm longis, glabris, luteolis, aristatis, aristis theca dimidio brevioribus, poro theca dimidio breviore, polline in tetradis. *Ovarium* 4-loculare, ovulis 4–6 in quoque loculo, 0,8–1,0 mm longum subcylindraceum, hispidum pilis stellatis; stylo 2,0–2,2 mm longo glabro; stigmate simplici, incluso. *Fructus* capsularis, septa ad basim libera, seminibus subsphaeroideis 0,6 mm diametro, reticulatis cellulis parvis multis. Figura 1.

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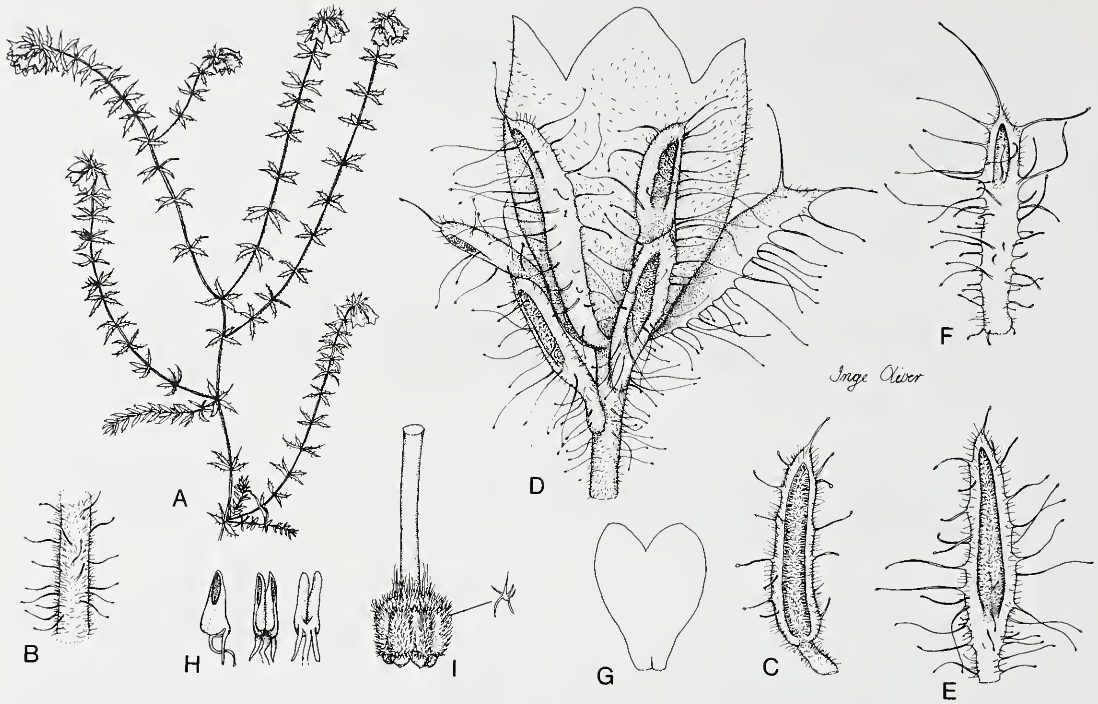

FIGURE 1.—*Erica abbottii*: A, flowering branch, × 2; B, branch; C, leaf; D, flower; E, bract; F, sepal; G, outline of corolla, × 12; H, anther, side, front and back views; I, gynoecium, with a stellate hair inset (× 50). B–F, H & I, × 25. All drawn from the type, *Abbott 2273* (STE).

TYPE.—3030 (Port Shepstone): Natal, Port Edward area, Umtamvuna Nature Reserve, Cascades, 18 December 1984, (–CC), *Abbott 2273* (PRE, holo.; NH, PRU, STE).

Shrublet sparse, weak, sprawling to 600 mm diam., pubescent all over and with scattered long gland-tipped hairs, the glands red. *Branches* thin and wiry with no infrafoliar ridges, internodes up to 10 mm long. *Leaves* 4-nate spreading, 2,5–3,0 mm long, oblong, acute, with a long apical hair, subopen-backed below; petiole 0,5 mm long, pubescent. *Flowers* 4–9 in heads at ends of main and lateral branches; pedicel 1,0–2,5 mm long, half the length of the corolla or shorter; bract median to subapproximate, foliaceous, 2,5–3,5 mm long, linear-lanceolate; bracteoles 2, approximate, subfoliaceous, only terminally sulcate, 2,5–3,5 mm long, linear-lanceolate. *Calyx* 4-partite, 2,5–3,8 mm long, half as long as to just longer than the corolla, narrowly oblong. *Corolla* 4-lobed, 3–5 mm long, obovoid-urceolate or obconical, white, lobes erect, broadly rounded, papillate, not hairy. *Stamens* 8, free, included, half the length of the corolla; filaments linear, apically sigmoid, glabrous; anthers sub-basally attached, 0,8–1,3 mm long, glabrous, pale yellow, pore half the length of the theca, aristate, the awns simple, pointing downwards and half the length of the theca; pollen in tetrads. *Ovary* 4-locular with 4–6 ovules per locule, 0,8–1,0 mm long, subcylindric and obtuse, hispid with stellate hairs; style 2,0–2,2 mm long, glabrous; stigma simple, included. *Fruit* a dehiscent capsule with septa free to the base; seeds relatively large subsphaeroid, 0,6 mm in diam., reticulate with numerous small cells. Figure 1.

Erica abbottii was recently collected by A. Abbott, a farmer in the Port Edward area, who is keenly interested in natural history and conservation. He is involved in a detailed survey of the species in the nearby Umtamvuna Nature Reserve and in the process has made some very interesting records, including several new species. When trying to identify this material we found that a more detailed study of the species in Section *Pseuderemia* was required in order to establish the taxonomic status of his collection and also its affinities. In this regard we are most grateful to him for his fine collections and his notes and photographs of *E. abbottii*.

The species is the only truly prostrate one in this section and as such is unique among those species occurring in the summer rainfall area of southern Africa. It forms prostrate, lax plants with long branches straggling among the low grasses in moist seepage areas or alongside streams. This character and the white corolla, pale yellow anthers, stellate hairs on the ovary and 4–6 ovules per locule serve to characterize *E. abbottii*.

The lax habit is not so well developed in *E. swaziensis* which has bright pink, very differently shaped flowers. It approaches *E. holtii* from the Drakensberg and eastern Transvaal in which the flowers are also white, but that species forms low compact many-stemmed shrublets in which the corolla is globose-urceolate with spreading lobes and 10–18 ovules per locule. The single collection of the latter species from the high Drakensberg of Natal, *Esterhuysen 20234*, is anomalous. The occurrence of stellate hairs on the ovary in *E. abbottii* is most unusual in the genus, but is shared with the *E. cooperi/baurii* complex which occurs further inland in the Transkei northwards to central Natal. However, this complex forms stout, woody, erect shrubs with stiff, dendroid hairs all over the plants and there are on average 20 ovules per locule.

E. abbottii is one of six species of *Erica* known to occur in the coastal areas of southern Natal and northern Transkei (Figure 2), the others being *E. aspalathifolia* H. Bol., *E. caffra* L., *E. cerinthoides* L., *E. cubica* L. and *E. natalitia* H. Bol. The new species is, however, the only one endemic to the area and as such is one of several endemic species in genera with their main distribution in the Cape Floral Region. Examples of this situation are clearly shown by *Leucospermum innovans* Rourke and *Leucadendron pondoense* Van Wyk, both in the Proteaceae, and *Raspalia trigyna* (Schltr.) Duemmer in the Bruniaceae. The phytogeography and endemism of this area is discussed fully by Van Wyk (1990a & b).

NATAL.—3030 (Port Shepstone): Umtamvuna Nature Reserve, Cascades, 8-1-1984, (—CC), *Abbott 1610* (NH, PRE); ibid., 18-12-84, *Abbott 2273* (NH, PRE, PRU, STE); Mpunzaana River just S of Umtamvuna/Hlolweni junction, 200 m, 24-1-86, (—AA), *Van Wyk 7249* (PRE).

TRANSKEI.—3129 (Port St Johns): Mkambati Game Reserve, Daza River, 13-12-86, (—BD), *Jordaan 1055* (K, MO, NH, PRE, STE). 3130 (Port Edward): Mzamba, Mzamba/Ntlakwe Rivers, 300 m, 29-10-87, (—AA), *Abbott 4041* (PRU, STE).

Erica swaziensis *E.G.H. Oliver*, sp. nov., in sectione *Pseuderemia*, distincta propter habitum laxum, internodos ramulorum florentium longos, flores roseos, pilos floribus typorum trium—eos multos breviores, eos intermediores glandulosos, eos longos simplices vel furcatos—aristas antherarum decurrentes.

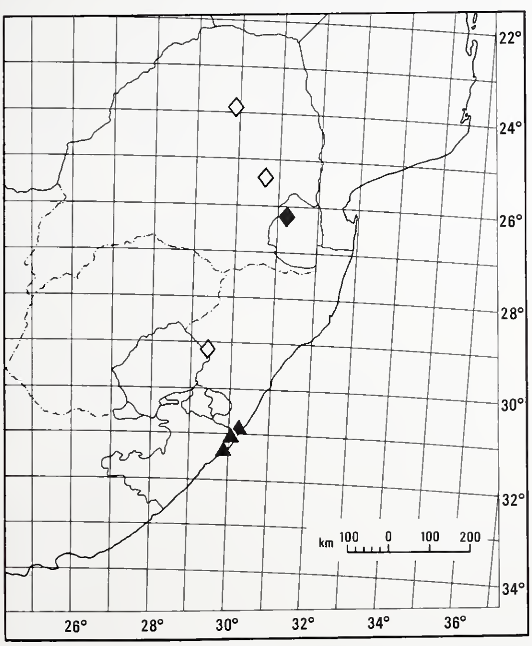

FIGURE 2.—The known distribution of *Erica abbottii*, ▲; *E. swaziensis*, ♦; and *E. holtii*, ◇.

Fruticulus laxus ad 400 mm altus vel effusus. *Rami* filo metallico similes, internodis ramulorum florentium ad 60 mm longis, pilosi pilis longis glandulosis glandibus albis. *Folia* 4-nata, suberecta, subimbricata, 2,0—2,5 mm longa, anguste ovata, in toto pilosa, ciliata pilis longis glandulosis. *Flores* 12 in capitis in extremis ramorum ramulorumque, pedicello 2 mm longo, pubescenti et pilis longis glandulosis; bractea subapproximata, 2 mm longa, lanceolata, pubescenti et pilis dispersis longioribus et etiam longioribus simplicibus furcatis; bracteolis 2 bractea similibus. *Calyx* 4-partitus, oblongus ad lanceolatus acutus, 1,7—2,0 mm longus, tubo corollae dimidio brevior, pubescente ut in bractea. *Corolla* 4-lobata rosea, tubo anguste ovoideo, 3 mm longo, glabro, lobis erectis ad subpatentibus, late ellipticis, 0,8 mm longis, papillatis papillatocrenulatis. *Stamina* 8, libera, inclusa, longitudine ¾ tubum corollae aequantia; filamentis linearibus, apice parum curvatis; antheris 0,6 mm longis, sub-basalibus, glabris, bubalinis, aristatis, aristis porum aequantibus, parum decurrentibus, serratis, poro longitudine ⅔ thecae partes aequanti, polline in tetradis. *Ovarium* 4-loculare ovulis 15 in quoque loculo, 1 mm longum, late obovoideum, hispidulum; stylo 1,5 mm longo glabro; stigma simplici, incluso. *Fructus* capsularis, septa ad basim libera, seminibus ovoideis, luteolis, reticulatis cellulis multis parvis. Figura 3.

TYPE.—2631 (Mbabane): Swaziland, Mbuluzi Falls, 9 April 1955, (—AA), *Compton 25085* (NBG, holo.; K, PRE).

Shrublet loose and straggling, 200—400 mm tall or spreading. *Branches* thin and wiry with slight infrafoliar ridges, internodes 10 mm long or less, up to 60 mm on flowering branches, pilose and with scattered long gland-tipped hairs, the glands white in young stages. *Leaves* 4-nate suberect and subimbricate, 2,0—2,5 mm long, narrowly ovate, pubescent all over, ciliate with long gland-tipped hairs; petiole very short, 0,2 mm long, pubescent. *Flowers* in heads of 12 at ends of main and lateral branches; pedicel 2 mm long, dark red, pubescent and with scattered long gland-tipped hairs; bract subapproximate, 2 mm long, lanceolate, pubescent and with a few scattered somewhat longer gland-tipped hairs and longer simple or fork-tipped hairs, red at base, sulcate and green in upper three-quarters; bracteoles 2, like the bract. *Calyx* 4-partite, oblong or lanceolate, acute, 1,7—2,0 mm long, half as long as the corolla, pubescent and with slightly longer scattered gland-tipped hairs, ciliate with long simple and fork-tipped hairs, red with apical green sulcate portion. *Corolla* 4-lobed, bright pink, tube narrowly ovoid, 3 mm long, glabrous, lobes erect to spreading, broadly elliptic, 0,8 mm long, papillate outside and inside, papillate-crenulate. *Stamens* 8, free, included, about three-quarters the length of the corolla tube; filaments linear, slightly curved at apex; anthers 0,6 mm long, sub-basally attached, glabrous, light brown, aristate, awns as long as the pore, slightly joined to the filament, with serrated edges, pore two thirds the length of the theca; pollen in tetrads. *Ovary* 4-locular with 15 ovules per locule, 1 mm long, broadly obovoid 8-lobed, covered with short stiff hairs; style 1,5 mm long, just shorter than corolla tube, glabrous; stigma simple. *Fruit* a dehiscent capsule with septa free to the base; seeds ovoid, pale yellow, with numerous small reticulate cells. Figure 3.

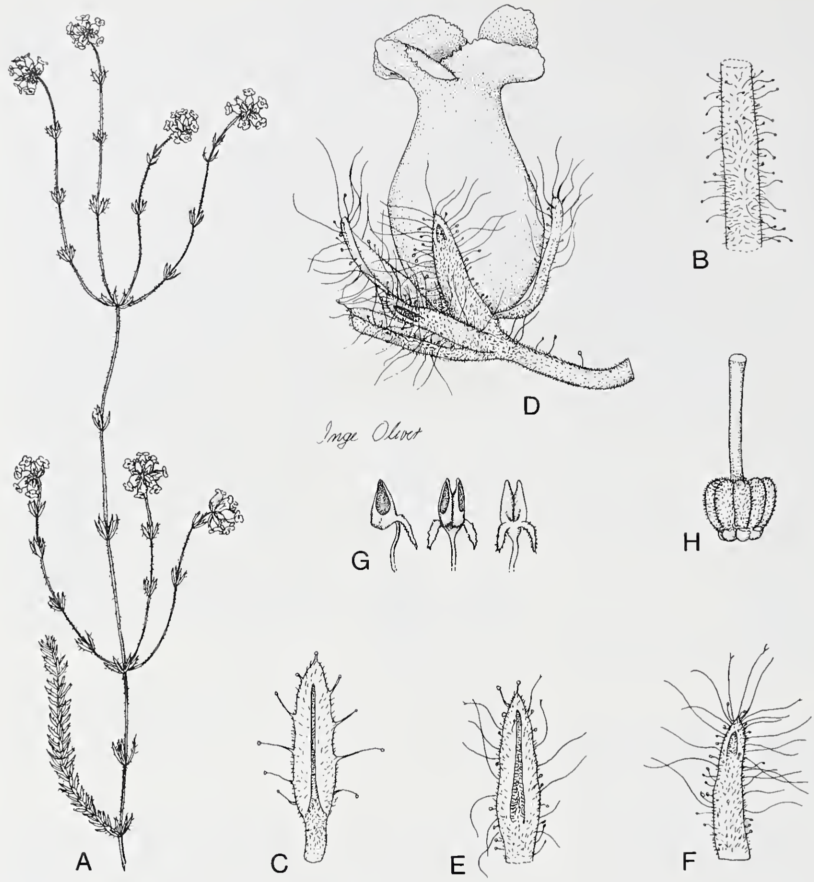

FIGURE 3.—*Erica swaziensis*: A, flowering branch, × 1; B, branch; C, leaf; D, flower; E, bract; F, sepal; G, anther, side, front and back views; H, gynoecium. B–H, × 25. All drawn from the type, *Compton 25085* (PRE).

This species is distinguished by its lax habit, the long internodes of the flowering branches, glabrous pink corolla with large spreading lobes, partly decurrent anthers and by the lack of glands on the longest hairs, but white glands on the medium-length hairs.

It is allied to the group of species described here in a number of characters. It differs from the rather lax, pink-flowered *E. ingeana*, which also has spreading corolla lobes, by the lobes being much wider than long and by the glabrous corolla, white glands on the medium-length hairs and the lack of glands on the long hairs.

E. swaziensis was listed by Compton (1976) as *E. holtii* which has an anomalous distribution from the type locality near Lydenburg on the eastern Transvaal escarpment to the high Drakensberg of Natal, from where it has been collected only once, *Esterhuysen 20234*, in 1952. The distribution of *E. holtii* has recently been extended further north to the Wolkberg, *Venter 10859a*. It is, however, a species with white, pubescent flowers of ovoid-urceolate shape with very small broadly rounded corolla lobes on plants which are multi-stemmed from a very woody base, the main branches being rather short.

Verdoorn (1954), when discussing the species of *Erica* from the Transvaal, mentioned the occurrence of *E. holtii* in Swaziland, presumably based on the old Nicholson collection in PRE. She noted, however, that the Swaziland material possessed longer and more urceolate flowers than the type.

The name of this species is appropriate because it is the only species of *Erica* confined to Swaziland. The other seven species are more widespread with *E. cerinthoides* occurring as far south as the Cape Peninsula and *E. woodii* from the southern Drakensberg to eastern Zimbabwe. *E. swaziensis* appears to be very localized in its distribution, being confined to the mountains just north and north-east of Mbabane. The habitat is not recorded on any of the collections, but Compton (1976) notes the habitat as 'sheltered grassy places'.

SWAZILAND.—2631 (Mbabane): Mbuluzi Falls, 9-4-1955, (–AA), *Compton 25085* (NBG, K, PRE); Miller's Falls, 1 370 m, 6-4-1956, (–AA/AC), *Compton 25854* (NBG); Black Umbuluzi Valley, 1 300 m, 24-2-1978, (–AA/AC), *Kemp 1301* (PRE); near Mbabane, 5-1939, (–AA/AC), *B. Nicholson in PRE 51217* (PRE).

Erica ingeana *E.G.H. Oliver*, sp. nov., in sectione *Pseuderemia* distincta propter lobos corollae roseae magnos longiores quam latiores, folia ovata, pilos longos molles omnes glandibus terminatos.

Fruticulus laxus decumbens usque erectus ad 300 mm altus. *Rami* filo metallico similes, pilosi et pilis dispersis longis glandulosis, glandibus atrorubentibus, internodis ad 20 mm longis. *Folia* 4-nata suberecta ad parum patentia, 2,0–2,5 mm longa petiolo 0,4 mm longo, ovata, sparse pilosa ciliata pilis longis glandulosis. *Flores* 12(16) in capitis in extremis ramorum ramulorumque; pedicello 2 mm longo; bractea remota ad mediana, 2 mm longa, ovata, pubescens et pilis dispersis longioribus glandulosis et pilis etiam longioribus simplicibus vel furcatis; bracteolis 2 bractea similibus. *Calyx* 4-partitus, 1,7 mm longus, tubo corollae dimidio brevior, anguste oblongus, pilis ut in bractea bracteolisque. *Corolla* 4-lobata, rosea, tubo 3 mm longo, anguste ovoideo, sparse piloso, lobis 1,0–1,3 mm longis, ellipticis, erectis ad patentibus, papillatis papillato-crenulatis. *Stamina* 8, libera, inclusa; filamentis linearibus apice sigmoideis; antheris 0,6 mm longis, sub-basalibus, glabris, poro longitudine $^{2}/_{3}$ thecae partes aequanti, aristatis, bubalinis, polline in tetradis. *Ovarium* 4-loculare ovulis 14 in quoque loculo, 9 mm longum, subcylindraceum, obtusum, pubescens apice hispidum; stylo 2,0–2,5 mm longo glabro; stigma simplici, manifesta. *Fructus* capsularis, septa ad basim libera, seminibus ovoideis reticulatis cellulis multis parvis. Figura 4.

TYPE.—3322 (Oudtshoorn): Swartberg, NE of Blesberg at head of Oorlogskloof, 1 647 m, 7 January 1975, (–BC), *I. Oliver sub E.G.H. Oliver 5656* (STE, holo.; BM, BOL, K, MEL, MO, P, PRE, S, W).

Shrublet straggling, single-stemmed, decumbent to erect and compact, up to 300 mm tall. *Branches* 200–400 mm long, wiry, pilose and with scattered long gland-tipped hairs, glands dark red, internodes up to 20 mm long on flowering branches, with no infrafoliar ridges. *Leaves* 4-nate, suberect to slightly spreading, 2,0–2,5 mm long with petiole 0,4 mm long, ovate, sparsely pilose all over and ciliate with long gland-tipped hairs. *Flowers* in heads of 12(16) at the ends of main and lateral branches; pedicel 2 mm long, pubescent and with long gland-tipped hairs, glands dark red; bract remote to median, 2 mm long, ovate, pubescent and with somewhat longer gland-tipped hairs and even longer simple or forked hairs, red at base with green sulcate upper half; bracteoles like bract, 2 mm long. *Calyx* 4-partite, segments about 1,7 mm long, half the length of the corolla tube, leaflike, narrowly oblong, pubescent and with somewhat longer gland-tipped hairs and even longer simple or fork-tipped hairs mostly confined to margins. *Corolla* 4-lobed, pink, tube 3 mm long, narrowly ovoid, sparsely pilose, lobes 1,0–1,3 mm long, elliptic, obtuse, erect to spreading, papillate abaxially, papillate-crenulate. *Stamens* 8, free, included; filaments linear apically sigmoid, half the length of the corolla tube; anthers 0,6 mm long, sub-basally attached, thecae rectangular, glabrous, pore $^{2}/_{3}$ length of theca, aristate, light brown, awns as long as the pore; pollen in tetrads. *Ovary* 4-locular with 14 ovules per locule, 9 mm long, subcylindric with obtuse to flattened apex and 8 external lobes, pubescent, apically hispid; style 2,0–2,5 mm long, glabrous; stigma simple, manifest. *Fruit* a dehiscent capsule with septa free to the base; seeds ovoid, reticulate with numerous small cells, yellow. Figure 4.

This species is distinguished among the small-flowered species of this section by its relatively long spreading corolla lobes which are longer than broad and are reminiscent of those in some species of Section *Euryloma*. It is most closely related to *E. solandra* which forms a stouter, erect shrub with numerous rigid, coarse hairs which are eglandular. *E. solandra* also has much larger leaves and dendroid teeth to the corolla lobes. *E. ingeana* resembles the new species, *E. swaziensis* above, in its large corolla lobes, but in that species the lobes are much broader than long and the corolla is glabrous.

Erica ingeana has been known from a number of collections since the first was made by Miss E.E. Esterhuysen in 1941. We were first introduced to this species through a collection made by one of us (I.M. Oliver) on a joint expedition to the Blesberg in 1975. The species occurs in moist seepage areas, which may be only seasonally wet, on the northern slopes of the eastern end of the Swartberg and also on the Anthoniesberg and the Kouga Mountains further east (Figure 5). *E. solandra* is confined to the slopes of a small section of the Outeniqua Mountains north and north-east of George where it grows in drier places which, however, receive a fairly high amount of rain.

CAPE.—3322 (Oudtshoorn): Swartberg, NE of Blesberg, head of Oorlogskloof, 1 647 m, 7-1-1975, (–BC), *Oliver 5656* (BM, BOL, K, MEL, MO, P, PRE, S, STE, W); Blesberg, top of Tierkloof, 1 830 m,

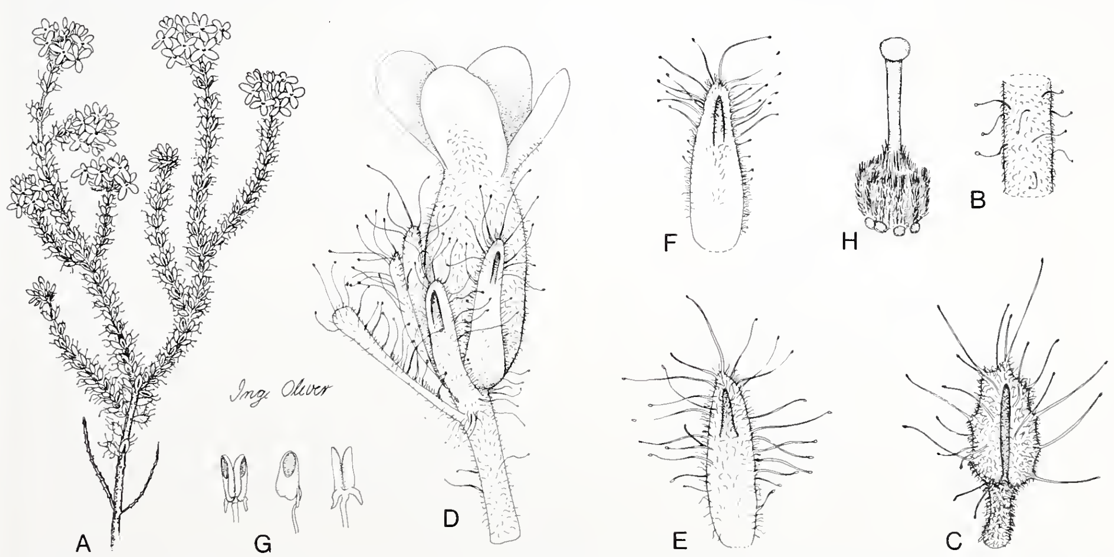

FIGURE 4.—*Erica ingeana*: A, flowering branch, × 1; B, branch; C, leaf; D, flower; E, bract; F, sepal; G, anther, front, side and back views; H, gynoecium. B–H, × 25. All drawn from the type, *Oliver 5656* (STE).

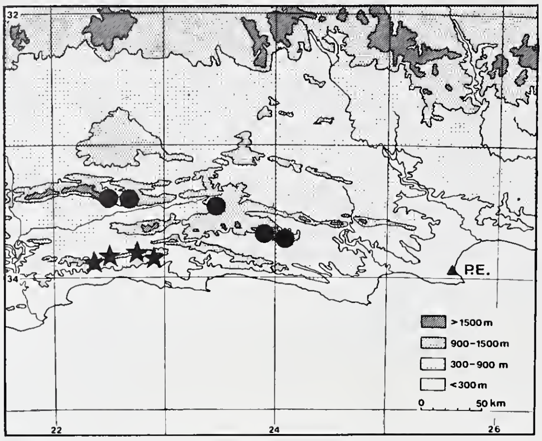

FIGURE 5.—The known distribution of *Erica ingeana*, ●; and *E. solandra*, ✱.

12-1-1981, *Vlok 102* (STE); ibid., 1 647 m, 4-2-1984, *Vlok 810* (STE); ibid., 1 660 m, 15-12-1986, (−BC), *Schumann 495* (STE); N base of Bloupunt at N entrance to Meiringspoort, 790 m, 15-7-1990, (−BC), *Vlok 2330* (STE). 3323 (Willowmore): Anthoniesberg S slopes, 1 500 m, 19-10-1955, (−AD), *Esterhuysen 24952* (BOL); Kouga Mtns, peak E of Smutsberg, 27-11-1941, (−DB), *Esterhuysen 7033* (BOL); foothills near Smutsberg, 900 m, 12-11-1944, (−DB), *Esterhuysen BOL 52462* (BOL). 3324 (Steytlerville): Kouga Mtns, foothills near Kouga Peak, 1 200 m, 14-11-1944, (−CA), *Esterhuysen 10835* (BOL).

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Cyanophyceae associated with mangrove trees at Inhaca Island, Mozambique

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Keywords: Bostrychietum, Cyanophyceae, epiphytes, Inhaca Island, mangrove, taxonomy

ABSTRACT

A survey of the Cyanophyceae associated with two of the five mangrove trees and their associated Bostrychieta at Inhaca Island, Mozambique, was undertaken. Sixteen taxa belonging to 12 genera were identified. Of these, six taxa were new records for Mozambique, three at generic and three at specific level. Thirteen taxa of Cyanophyceae were found growing on *Avicennia marina* (Forssk.) Vierh. and four on *Ceriops tagal* (Perr.) C.B. Robinson. *Chamaecalyx leibleiniae* (H. Reinsch) Komarek & Anagnostidis was the only Cyanophyceae to occur on both species of tree.

UITTREKSEL

'n Opname van Cyanophyceae wat geassosieer word met twee van die vyf manglietbome en hul geassosieerde Bostrychieta op Inhaca Eiland, Mosambiek, is gedoen. Sestien taksons wat aan 12 genera behoort, is geïdentifiseer. Ses van hierdie taksons was nuwe rekords vir Mosambiek, drie op genusvlak en drie op spesievlak. Daar is gevind dat dertien Cyanophyceae-taksons op *Avicennia marina* (Forssk.) Vierh. groei en vier op *Ceriops tagal* (Perr.) C.B. Robinson. *Chamaecalyx leibleiniae* (H. Reinsch) Komarek & Anagnostidis was die ênigste Cyanophyceae wat op albei boomspesies voorgekom het.

INTRODUCTION

After a long period of neglect, some attention has recently been given to epiphytic Cyanophyceae associated with mangroves with respect to their abundance and importance within this particular habitat (Berjak *et al.* 1977; Dor 1984; Lambert *et al.* 1989).

The Cyanophyceae from southern African mangroves were studied in detail by Lambert *et al.* (1989). This report constitutes an important contribution to our knowledge of the ecology and taxonomy of the Cyanophyceae in that region. The northern limit of sampling by Lambert *et al.* (1989) was in the Kosi Estuary which borders Mozambique (Figure 1B). Inhaca Island is situated ± 180 km to the north, on the east coast of southern Africa, within the Indo-West-Pacific biogeographic zone of the degree squares 2532DD and 2632BB (see Edwards & Leistner 1971) (Figure 1A, B). It is of interest because of the well-zoned mangrove swamps, a feature not apparent in the swamps to the south (Berjak *et al.* 1977). The island is situated in the south of Mozambique, forming part of the barrier between the Indian Ocean and Maputo Bay (Figure 1). The largest stands of mangroves are located at the head of the northern and the southern bays (Figure 1C) (Macnae & Kalk 1969).

The mangrove vegetation on Inhaca Island is mainly composed of the following: *Avicennia marina* (Forssk.) Vierh., *Bruguiera gymnorrhiza* (L.) Lam., *Ceriops tagal* (Perr.) C.B. Robinson, *Lumnitzera racemosa* Willd. and *Rhizophora mucronata* Lam. *Ceriops tagal* occupies the central areas of all mangrove swamps on the island and macroscopic growth of algae on its trunks is generally very scarce. *Avicennia marina* is a dominant member of the mangrove community. The pneumatophores very often possess a covering of several species of Rhodophyceae which are collectively known as 'Bostrychietum', which is defined thus by the predominance of species such as *Bostrychia* spp., *Catenella* spp., *Caloglossa* sp. and *Murrayella* sp. (Post 1936; Macnae & Kalk 1962).

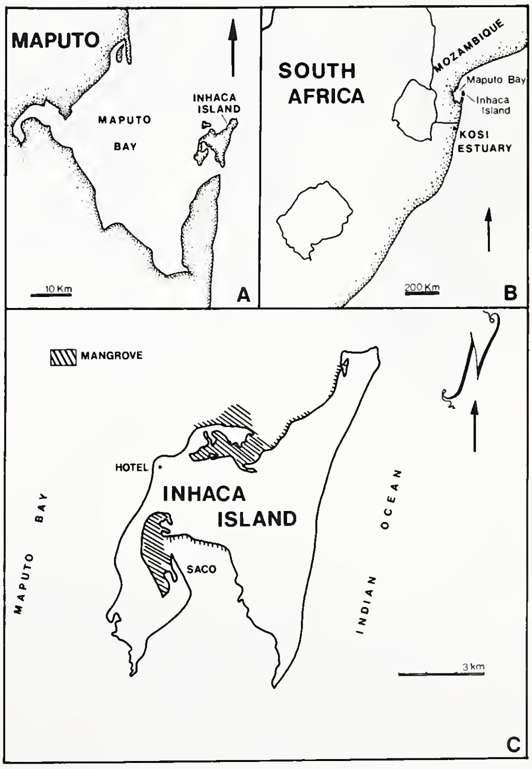

FIGURE 1.—Localization of the study site.

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MS. received: 1991-05-03.

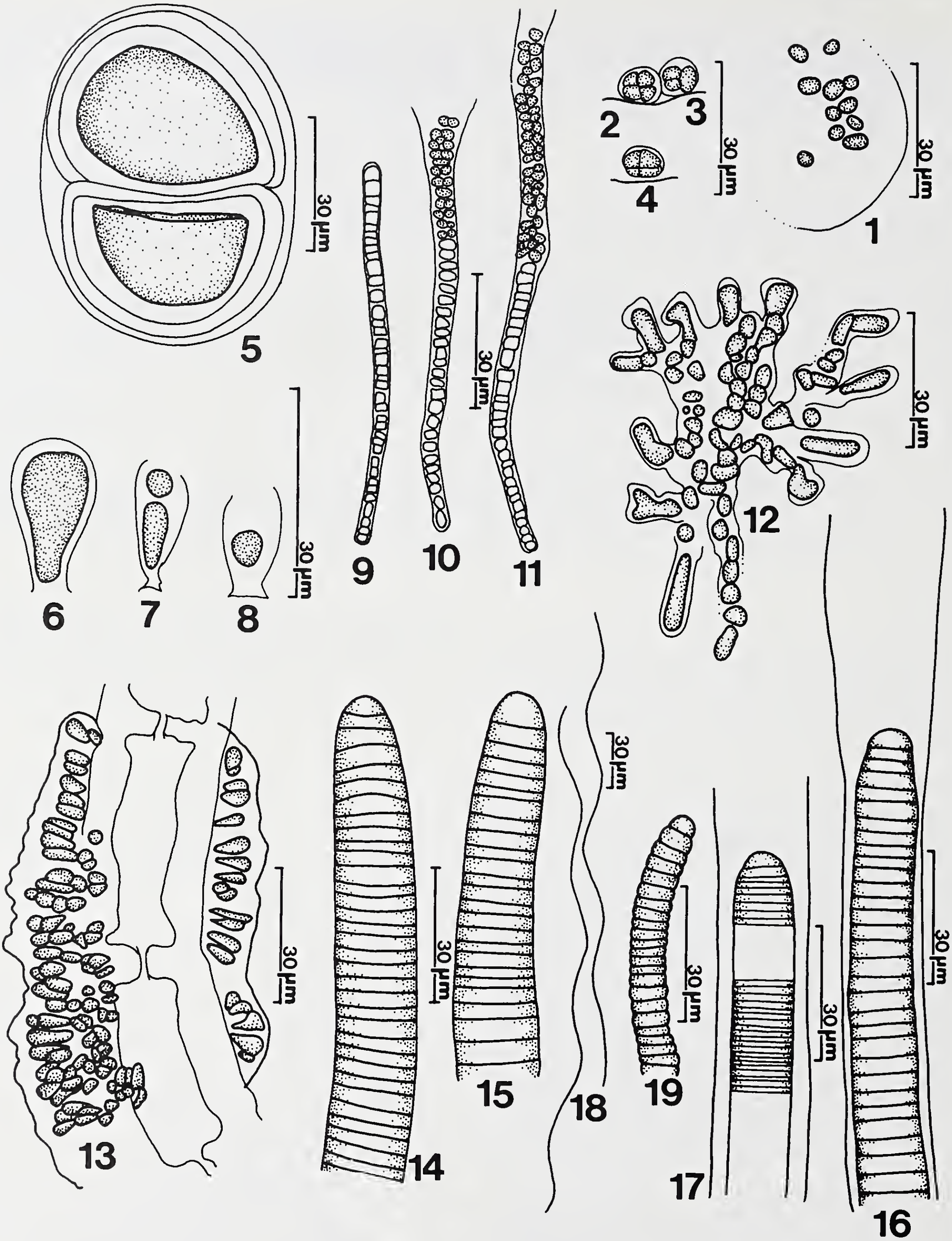

FIGURE 2.—1, *Aphanothece stagnina*, detail of part of a colony. 2–4, *Chroococcus minor*. 5, *C. turgidus* var. *maximus*. 6–8, *Chamaecalyx leibleiniae*: 6, young plant; 7, exocytes in a colony; 8, liberation. 9–11, *Stichosiphon* sp.: 9, young plant; 10, 11, formation and liberation of exocytes. 12, *Hydrococcus rivularis*, apical view of the filaments radiating from pseudoparenchyma. 13, *Xenococcus acervatus*, apical and lateral view. 14, 15, *Oscillatoria jenensis*, detail of trichomes. 16, *Lyngbya nigra*. 17, *L. confervoides*. 18, 19, *Arthrospira platensis*: 18, general aspect of the filaments; 19, detail of the trichomes.

No research on the Cyanophyceae associated with the mangroves of Mozambique has yet been undertaken. The aim of this study was to identify those algae growing on mangrove trees as well as to contribute to our knowledge of their taxonomy and ecology in southern Africa.

MATERIALS AND METHODS

Two substrata which support the growth of benthic algae were considered for this study, viz.: the pneumatophores of *Avicennia marina* and the base of the trunks of *Ceriops tagal*. Sampling was carried out in the northern bay and at Saco during low tide. Twenty samples of the pneumatophores were collected at random, cutting them near the mud surface. In the case of *C. tagal*, trunk segments were removed. Macro-algal hosts within the Bostrychieta were noted. The number of samples analysed was not sufficient to indicate any marked changes in algal composition from the water's edge to the upper limit of the pneumatophores.

Some material was preserved in 4% formalin, and some was allowed to dry in subdued lighting. All samples were deposited at the Herbarium of the Faculty of Biology (LMU), University Eduardo Mondlane in Maputo, Mozambique.

The system of classification used was Anagnostidis & Komarek (1985, 1988) and Komarek & Anagnostidis (1986, 1989).

RESULTS

Key to the species

1a Thallus unicellular or colonial:
- 2a Unicellular .... *Chamaecalyx leibleiniae*
- 2b Colonial:
  - 3a Pseudoparenchymatous .... *Xenococcus acervatus*
  - 3b Not pseudoparenchymatous, subspheric or elongate:
    - 4a Many cells per colony .... *Aphanothece stagnina*
    - 4b Up to 4 cells per colony:
      - 5a Cells 3,1–4,3 μm broad .... *Chroococcus minor*
      - 5b Cells 31,8–38,1 μm broad .... *C. turgidus* var. *maximus*

1b Thallus filamentous or pseudofilamentous:
- 6a Pseudofilamentous:
  - 7a Pseudofilaments irradiating from pseudoparenchyma .... *Hydrococcus rivularis*
  - 7b Pseudofilaments single, not forming pseudoparenchyma .... *Stichosiphon* sp.
- 6b Filamentous:
  - 8a With heterocysts:
    - 9a Heterocysts intercalar only .... *Nodularia* sp.
    - 9b Heterocysts terminal:
      - 10a Heterocysts terminal only, cells 9,6–11,8 μm broad .. .. *Calothrix scopulorum*
      - 10b Heterocysts terminal and intercalar, cells 19,8–28,1 μm broad .... *C. crustacea*
  - 8b Without heterocysts:
    - 11a Sheath absent:
      - 12a Trichomes regularly spirally coiled .... *Arthrospira platensis*
      - 12b Trichomes bent, not regularly spirally coiled .... *Oscillatoria jenensis*
    - 11b Sheath present:
      - 13a Many trichomes per sheath ..... *Microcoleus chthonoplastes*
      - 13b Only one trichome per sheath:
        - 14a Sheath thick, lamellated, filaments 50,0–52,1 μm broad .... *Lyngbya majuscula*
        - 14b Sheath thin, unlamellated, filaments 6,2–20,6 μm broad:
          - 15a Filaments 17,1–18,7 μm broad .... *L. nigra*
          - 15b Filaments 19,0–20,6 μm broad .... *L. confervoides*

CHROOCOCCALES

Microcystaceae

Aphanothece stagnina *(C.K. Spreng.) A. Braun*, In Rabenhorst: 66 (1865); Tilden: 32 (1910); Geitler: 164 (1932); Desikachary: 137 (1959); Humm & Wicks: 49 (1980) [=*Coccochloris stagnina* Drouet & Daily].

Thallus generally subspherical, ± 102,5 μm. *Sheath* colourless, lamellated, up to 15,6 μm thick. *Cells* oblong or polygonal by mutual compression, 3,1–5,6 × 2,8–3,4 μm, protoplasm homogeneous blue-green (Figure 2.1).

Specimens examined

MOZAMBIQUE.—2632 (Bela Vista): Inhaca Island, near the northern bay, 07-09-1989, *S. Silva & N. Cuamba 43* (LMU).

Distribution in Mozambique: Gaza: Muchopes, Chidenguele (Rino 1972). 2632 (Bela Vista): Inhaca Island (Rino 1972); marine, on rocks and sand (Silva 1991); Namaacha (Rino 1972). Sul do Save: Rino (1979).

Chroococcaceae

Chroococcus minor *(Kützing) Näg.*: 47 (1849); Tilden: 9 (1910); Geitler: 240 (1932); Desikachary: 105 (1959).

Colony subspherical, groups of 3–4 cells. *Sheath* thin, colourless or yellowish lamellated. *Cells* generally hemispherical or subhemispherical, protoplasm homogeneous pale blue-green, 2,8–4,0 × 3,1–4,3(–6,2) μm (Figure 2.2, 2.3, 2.4).

Specimens examined

MOZAMBIQUE.—2632 (Bela Vista): Inhaca Island, near the northern bay, 14-07-1988, *S. Silva & N. Cuamba 26*; near the 'Saco Inhaca', 24-06-1988, *S. Silva & N. Cuamba 2* (LMU).

Distribution in Mozambique: 2335 (Inhambane): Vilanculos (Rino 1969).

Chroococcus turgidus *(Kützing) Näg.* var. **maximus** *Nygaard*: 201 (1926); Tilden: 5 (1910); Geitler: 229 (1932); Desikachary: 102 (1959).

Colony subspherical or elongate, groups of 2 cells. *Sheath* colourless, lamellated, ± 11,5 μm thick. *Cells* hemispherical, 17,7–30,3 × 31,8–38,1 μm, protoplasm granular dark green. (Figure 2.5).

Specimens examined

MOZAMBIQUE.—2632 (Bela Vista): Inhaca Island, near the northern bay, 07-09-1989, *S. Silva & N. Cuamba 43* (LMU).

Distribution in Mozambique: 2335 (Inhambane): Inharrime (Rino 1972). 2632 (Bela Vista): Inhaca Island, marine, on sand (Silva 1991).

Chamaesiphonaceae

Chamaecalyx leibleiniae *(H. Reinsch) Komarek & Anagnostidis*: 199 (1986); Geitler: 399 (1932) [=*Dermocarpa leibleiniae* (H. Reinsch) Born. & Thur.]; Desikachary: 173 (1959) [=*Dermocarpa leibleiniae* (H. Reinsch) Born. & Thur.]; Humm & Wicks: 62 (1980) [=*Entophysalis conferta* Drouet & Daily].

Sporangia single or gregarious, club-shaped, straight or bent, 22,5–46,8 × (8,4–)10,0–19,6 μm, protoplasm homogeneous pale blue-green. *Sheath* thin, colourless. *Exocytes* many, ± 9, 4,0–8,1 μm broad. (Figure 2.6, 2.7, 2.8).

Specimens examined

MOZAMBIQUE.—2632 (Bela Vista): Inhaca Island, near the 'Saco Inhaca', 24-06-1988, *S. Silva, N. Cuamba & D. Gove 3*; near the northern bay, 14-07-1988, *S. Silva & N. Cuamba 25, 28* (LMU).

Distribution in Mozambique: 2632 (Bela Vista): Inhaca Island, marine, on *Cladophora* sp. (Silva 1991).

Stichosiphon sp.

Sporangia single, erect or bent, up to 122,0 × 2,5–6,5 μm. *Sheath* thin, colourless, homogeneous. *Cells* 1,5–2,8 × 1,8–3,4(–4,0) μm, protoplasm homogeneous blue-green. *Exocytes* many, ± 44. (Figure 2.9, 2.10, 2.11).

Specimens examined

MOZAMBIQUE.—2632 (Bela Vista); Inhaca Island, near the northern bay, 07-09-1989, *S. Silva & N. Cuamba 43* (LMU).

Distribution in Mozambique: first record for the occurrence of the genus.

The specimens of *Stichosiphon* Geitl. studied probably constitute a new species. However, more detailed studies in culture should be undertaken in order to elucidate the development and reproduction of this alga.

Hydrococcaceae

Hydrococcus rivularis *Kützing*: 380 (1833); Tilden: 45 (1910) [=*Oncobirsa rivularis* (Kützing) Menegh.]; Geitler: 362 (1932) [=*Oncobirsa rivularis* (Kützing) Menegh.]; Desikachary: 180 (1959).

Thallus dark green, discoid, pseudoparenchymatous. *Pseudofilaments* generally branched, radially arranged. *Sheath* colourless, diffluent, generally indistinct. *Cells* (1,5–)2,5–4,6 × 2,5–3,1 μm (Figure 2.12).

Specimens examined

MOZAMBIQUE.—2632 (Bela Vista): Inhaca Island, near the northern bay, 07-09-1989, *S. Silva & N. Cuamba 43*; near the 'Saco Inhaca', 24-06-1988, *S. Silva & N. Cuamba 2* (LMU).

Distribution in Mozambique: first record for the occurrence of the genus.

Xenococcaceae

Xenococcus acervatus *Setch. & N.L. Gardner*, In Gardner: 459 (1918); Geitler: 333 (1932); Desikachary: 182 (1959); Humm & Wicks: 62 (1980) [=*Entophysalis conferta* Drouet & Daily].

Thallus dark green, lobed, pseudoparenchymatous, single layered. *Sheath* thick, colourless, unlamellated. *Cells* 5,9–11,2 × 2,5–3,4 μm (Figure 2.13).

Specimens examined

MOZAMBIQUE.—2632 (Bela Vista): Inhaca Island, near the northern bay, 07-09-1989, *S. Silva & N. Cuamba 43* (LMU).

Distribution in Mozambique: first record for the occurrence of the species.

OSCILLATORIALES

Oscillatoriaceae

Oscillatoria jenensis *G. Schmid*: 572 (1921); Geitler: 949 (1932).

Trichomes bent, not constricted at the cross-walls, slightly attenuated or not at the ends. *Cells* 4–9 times broader than long, (1,5–)2,1–5,3 × 14,3–19,6 μm, cross-walls not granular, protoplasm homogeneous blue-green (Figure 2.14, 2.15).

Specimens examined

MOZAMBIQUE.—2632 (Bela Vista): Inhaca Island, near the northern bay, 14-07-1988, *S. Silva & N. Cuamba 25* (LMU).

Distribution in Mozambique: first record for the occurrence of the species.

Lyngbya nigra *C. Agardh ex Gomont*: 145 (1892); Tilden: 119 (1910); Geitler: 1063 (1932); Desikachary: 317 (1959).

Filaments long, flexuous, 17,1–18,7 μm broad. *Sheath* thin, colourless, unlamellated. *Trichome* not constricted at the cross-walls, slightly attenuated or not. *Cells* 3–5 times broader than long, 2,5–4,6 × 13,4–15,0 μm, cross-walls not granular, protoplasm granular blue-green. *Calyptra* roundish (Figure 2.16).

Specimens examined

MOZAMBIQUE.—2632 (Bela Vista): Inhaca Island, near the northern bay, 07-09-1989, *S. Silva & N. Cuamba 43* (LMU).

Distribution in Mozambique: first record for the occurrence of the species.

Lyngbya confervoides *C. Agardh ex Gomont*: 156 (1892); Tilden: 119 (1910); Geitler: 1061 (1932); Desikachary: 314 (1959); Humm & Wicks: 81 (1980) [=*Microcoleus lyngbyaceus* (Kützing) P.L. Crouan].

Filaments long, flexuous, 19,0–20,6 μm broad. *Sheath* thin, colourless, unlamellated. *Trichome* not constricted at the cross-walls, not attenuated at the ends. *Cells* 7–12 times broader than long, 1,2–2,1 × 14,0 μm, cross-walls not granular, protoplasm homogeneous dark green. *Calyptra* absent (Figure 2.17).

Specimens examined

MOZAMBIQUE.—2632 (Bela Vista): Inhaca Island, near the northern bay, 07-09-1989, *S. Silva & N. Cuamba 43* (LMU).

Distribution in Mozambique: 2632 (Bela Vista): Inhaca Island, marine, on rocks, on *Crassostrea* sp. and mixed with *Bostrychia* spp. and *Catenella* sp. (Silva 1991); plankton (Silva & Cuamba 1991).

Lyngbya majuscula *Harv. ex Gomont*: 151 (1892); Tilden: 123 (1910); Geitler: 1060 (1932); Desikachary: 313 (1959); Humm & Wicks: 81 (1980) [=*Microcoleus lyngbyaceus* (Kützing) P.L. Crouan].

Filaments long, flexuous, 50,0–52,1 μm broad. *Sheath* colourless, lamellated, ± 3,4 μm thick. *Trichome* not constricted at the cross-walls, not attenuated at the ends. *Cells* 9–10 times broader than long, 2,1–5,0(–10,9) × 39.0-45,0 μm, cross-walls not granular. *Protoplasm* homogeneous dark green. *Calyptra* absent (Figure 3.1).

Specimens examined

MOZAMBIQUE.—2632 (Bela Vista): Inhaca Island, near the northern bay, 07-09-1989, *S. Silva & N. Cuamba 43* (LMU).

Distribution in Mozambique: 2335 (Inhambane): Massinga (Rino 1972). 2632 (Bela Vista): Inhaca Island, marine (Pocock 1969); mixed with *Bostrychia* spp. and tree trunks in decomposition (Silva 1991); plankton (Silva & Cuamba 1991).

Phormidiaceae

Arthrospira platensis *(Nordst.) Gomont*: 247 (1892); Geitler: 919 (1932) [= *Spirulina platensis* (Nordst.) Geitl.]; Desikachary: 190 (1959).

Trichomes constricted at the cross-walls, not attenuated at the ends. *Spirals* 75,0 μm distant from each other. *Cells* 3–4 times broader than long, 1,8–3,1 × 7,5–8,4 μm, protoplasm homogeneous blue-green (Figure 2.18, 2.19).

Specimens examined

MOZAMBIQUE.—2632 (Bela Vista): Inhaca Island, near the 'Saco Inhaca' 24-06-1988, *S. Silva, N. Cuamba & D. Gove 3* (LMU).

Distribution in Mozambique: first record for the occurrence of the genus.

Microcoleus chthonoplastes *Thur. ex Gomont*: 353 (1892); Tilden: 155 (1910); Geitler: 1133 (1932); Desikachary: 343 (1959); Humm & Wicks: 73 (1980) [=*Schizothrix arenaria* (Berk.) Gomont].

Filaments single, bent, unbranched, attenuated to the apex, ± 80, 0 μm. *Sheath* colourless or yellowish, unlamellated, ± 24,0 μm thick. *Trichomes* constricted at the cross-walls, cross-walls not granular. *Cells* 0,1–1,4 times broader than long, 5,3–10,3 × 4,3–7,5 μm, protoplasm homogeneous blue-green. *End cells* conical, not capitate (Figure 3.2, 3.3).

Specimens examined

MOZAMBIQUE.—2632 (Bela Vista): Inhaca Island, near the northern bay, 07-09-1989, *S. Silva & N. Cuamba 43*; near the 'Saco Inhaca', 24-06-1988, *S. Silva & N. Cuamba 2* (LMU).

Distribution in Mozambique: 2632 (Bela Vista): Inhaca Island, marine, on sand and mixed with *Bostrychia* spp. and *Catenella* sp. (Silva 1991).

NOSTOCALES

Nostocaceae

Nodularia sp.

Filaments single, straight or bent, 16,2–20,0 μm broad. *Sheath* thin, colourless, unlamellated. *Trichome* constricted at the cross-walls. *Cells* generally 3 times broader than long or subquadratic, 3,7–10,9 × 11,5–13,1 μm, protoplasm homogeneous blue-green. *Heterocysts* colourless, depressed spherical or cylindrical, 13,7–15,6 × 11,2–16,8 μm. *Akinetes* not observed (Figure 3.4).

Specimens examined

MOZAMBIQUE.—2632 (Bela Vista): Inhaca Island, near the northern bay, 07-09-1989, *S. Silva & N. Cuamba 43* (LMU).

The specimens of *Nodularia* Mert. ex Born. & Flah. were not identified to species level due to lack of akinetes.

Rivulariaceae

Calothrix crustacea *Thur. ex Born. & Flah.*: 353 (1886); Tilden: 264 (1910); Geitler: 601 (1932); Desikachary: 523 (1959); Humm & Wicks: 151 (1980).

Thallus caespitose, dark-green. *Filaments* bent, ± 1400,0 × 20,0–35,3 μm, slightly swollen at the base, not attenuated into a hair. *Sheath* colourless or yellowish, lamellated, ± 6,5 μm thick. *Trichome* constricted at the cross-walls. *Cells* generally 0,7–2,0 times longer than broad, (1,5–)3,4–10,9 × 19,6–28,1 μm, protoplasm granular blue-green. *Heterocysts* 1-basal, 1–2-intercalar, protoplasm yellowish, (6,8–)15,3–35,3 × (12,1–)20,3–27,8 μm. *Hormogonia* not observed (Figure 3.5, 3.6, 3.7).

Specimens examined

MOZAMBIQUE.—2632 (Bela Vista): Inhaca Island, near the northern bay, 14-07-1988, *S. Silva & N. Cuamba 26* (LMU).

Distribution in Mozambique: 2632 (Bela Vista): Inhaca Island, marine, on *Crassostrea* sp. (Silva 1991).

Calothrix scopulorum *(F. Weber & D. Mohr) C. Agardh ex Born. & Flah.*: 359 (1886); Tilden: 258 (1910); Geitler: 600 (1932); Desikachary: 524 (1959); Humm & Wicks: 84 (1980) [=*Calothrix crustacea* Schousb. & Thur.].

Filaments single, bent, ± 120,0 × 15,9–17,8 μm, slightly swollen at the base, not tapering into a hair. *Sheath* colourless, unlamellated, ± 2,8 μm thick. *Trichome* not constricted at the cross-walls. *Cells* 2–6 times broader than long, 2,1–4,3 × 9,6–11,8 μm, protoplasm granular blue-green. *Heterocysts* 1-basal, protoplasm yellowish, 18,4 × 9,6 μm . *Hormogonia* 35,0 × 9,6 μm (Figure 3.8).

Specimens examined

MOZAMBIQUE.—2632 (Bela Vista): Inhaca Island, near the northern bay, 07-09-1989, *S. Silva & N. Cuamba 43* (LMU).

Distribution in Mozambique: 2632 (Bela Vista): Inhaca Island, marine plankton (Silva & Cuamba 1991).

DISCUSSION

The Cyanophyceae on mangrove trees at Inhaca Island were found frequently associated with several species of red algae in the so-called 'Bostrychietum' on pneumatophores of *Avicennia marina*. These Cyanophyceae were also found on the base of trunks of *Ceriops tagal* where the number of taxa was lower than that observed on

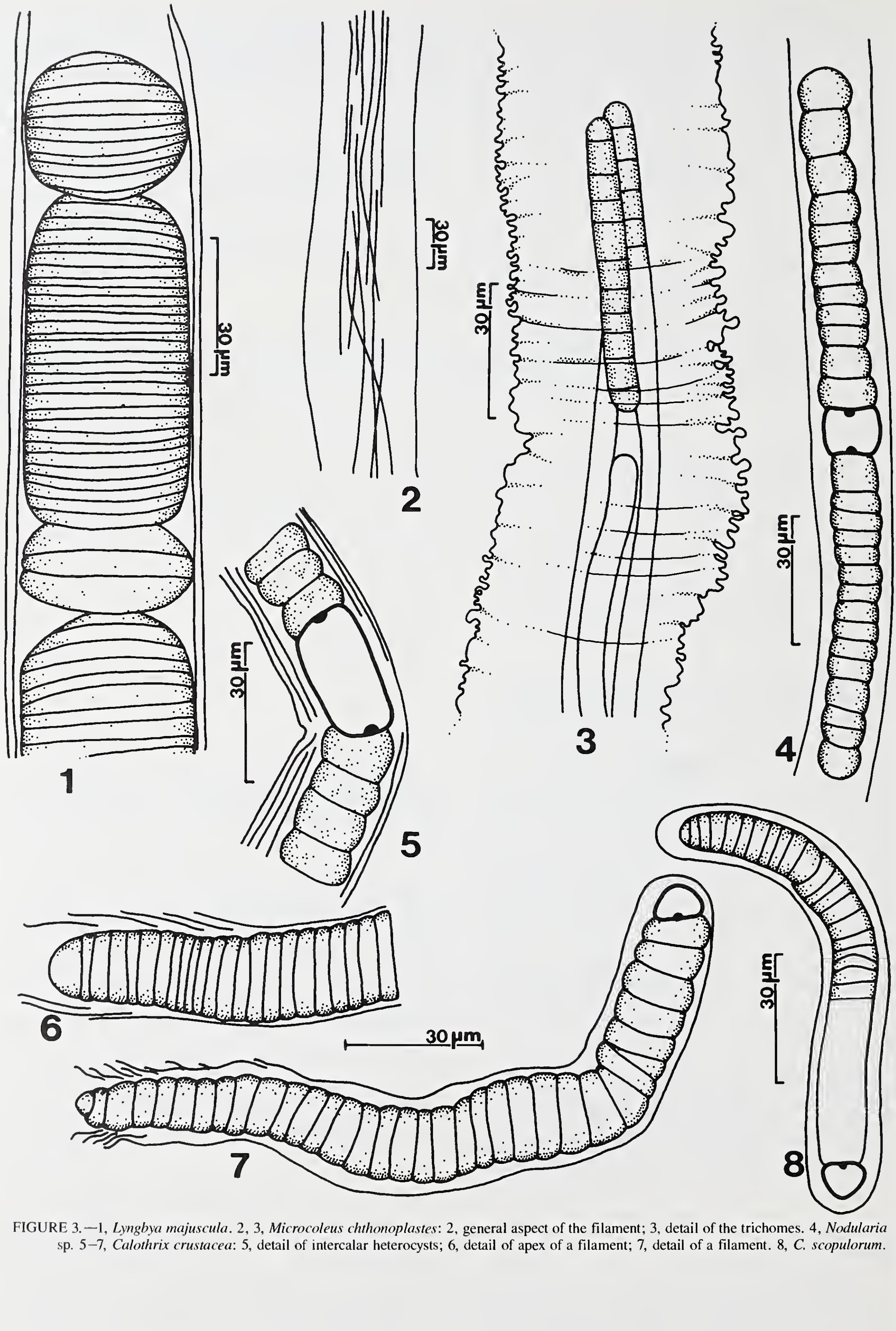

FIGURE 3.—1, *Lyngbya majuscula*. 2, 3, *Microcoleus chthonoplastes*: 2, general aspect of the filament; 3, detail of the trichomes. 4, *Nodularia* sp. 5–7, *Calothrix crustacea*: 5, detail of intercalar heterocysts; 6, detail of apex of a filament; 7, detail of a filament. 8, *C. scopulorum*.

pneumatophores (Table 1). This observation can be explained in that the 'Bostrychietum' offers a suitable micro-habitat for the development of Cyanophyceae where they are less susceptible to extreme environmental conditions such as desiccation, high light intensity and high temperature conditions than on the base of *C. tagal*. Besides, *C. tagal* occurs fairly high up the shore where tidal inundations are less frequent.

Sixteen taxa of Cyanophyceae were identified, which included 12 genera (*Aphanothece, Arthrospira, Calothrix, Chamaecalyx, Chroococcus, Hydrococcus, Lyngbya, Microcoleus, Nodularia, Oscillatoria, Stichosiphon* and *Xenococcus*) and 14 species (*Aphanothece stagnina* (C.K. Sprengel) A. Braun, *Arthrospira platensis* (Nordst.) Gomont, *Chroococcus minor* (Kützing) Nägeli, *C. turgidus* (Kützing) Nägeli var. *maximus* Nygaard, *Calothrix crustacea* Thur. ex Born. & Flah., *C. scopulorum* (F. Weber & D. Mohr) C. Agardh ex Born. & Flah., *Chamaecalyx leibleiniae* (H. Reinsch) Komarek & Anagnostidis, *Hydrococcus rivularis* Kützing, *Lyngbya confervoides* C. Agardh ex Gomont, *L. majuscula* Harv. ex Gomont, *L. nigra* C. Agardh ex Gomont, *Microcoleus chthonoplastes* Thur. ex Gomont, *Oscillatoria jenensis* G. Schmid and *Xenococcus acervatus* Setch. & N.L. Gardner. In addition, *Stichosiphon* sp. probably constitutes a new species and *Nodularia* sp. could not be identified further due to the lack of reproductive material. *Arthrospira platensis, Hydrococcus rivularis* and *Stichosiphon* sp. are recorded for the first time at the generic level and *Lyngbya nigra, Oscillatoria jenensis* and *Xenococcus acervatus* are first records at the specific level for Mozambique.

Of the identified species, 75% were found growing exclusively on *Avicennia marina* and 18% only on *Ceriops tagal*. On *A. marina*, eight taxa were not associated with macroalgae (*Aphanothece stagnina, Chroococcus turgidus* var. *maximus, Arthrospira platensis, Lyngbya nigra,*

TABLE 1.—Mangrove substrata upon which the species of Cyanophyceae were found

Taxon	Substrata: *Avicennia marina* A	B	C	Ca	G	M	*Ceriops tagal* Ce	C	Cy
Aphanothece stagnina	+								
Chroococcus									
minor									+
turgidus var. *maximus*	+								
Chamaecalyx leibleiniae				+		+		+	
Stichosiphon sp.					+	+			
Hydrococcus rivularis		+			+	+			
Xenococcus acervatus		+			+				
Oscillatoria jenensis							+		
Arthrospira platensis	+								
Lyngbya									
nigra	+								
confervoides	+								
majuscula	+								
Microcoleus chthonoplastes	+	+	+		+	+			
Nodularia sp.	+								
Calothrix									
crustacea							+		
scopulorum	+								

A, *Avicennia marina*; B, *Bostrychia* spp.; C, *Caloglossa* sp.; Ca, *Catenella* sp.; Ce, *Ceriops tagal*; Cy, Cyanophyceae; G, *Gelidium* sp.; M, *Murrayella* sp.

TABLE 2.—The diversity of Cyanophyceae recorded from the mangroves of South Africa and Inhaca Island, Mozambique

Taxon	Lambert *et al.* (1989) southern coast of South Africa	Inhaca Island Mozambique
Aphanocapsa		
elachista var. *conferta*	+	
montana	+	
Aphanothece stagnina		+
Arthrospira platensis		+
Chroococcus		
hansgirgii	+	
minor		+
turgidus	+	
turgidus var. *maximus*		+
Calothrix		
contarenii	+	
crustacea		+
scopulorum	+	+
Chamaecalyx leibleiniae		+
Dermocarpa olivacea	+	
Hydrococcus rivularis	+	+
Lyngbya		
baculum	+	
cinerescens	+	
confervoides	+	+
lutea	+	
majuscula		+
nigra		+
Microcoleus chthonoplastes	+	+
Nodularia sp.		
Oscillatoria		
chlorina	+	
corallinae	+	
jenensis		+
limosa	+	
nigroviridis	+	
proboscidea	+	
schultzii	+	
subbrevis	+	
Phormidium ambiguum	+	
Rivularia bullata	+	
Schizothrix arenaria	+	
Scytonema hofmannii	+	
Spirulina subsalsa	+	
Stichosiphon sp.		+
Xenococcus		
acervatus	+	+
kerneri	+	

\+ presence.

L. confervoides, L. majuscula, Nodularia sp. and *Calothrix scopulorum*), but four were present on at least two different genera of macroalgae (*Chamaecalyx leibleiniae, Stichosiphon* sp., *Hydrococcus rivularis* and *Xenococcus acervatus*). *Microcoleus chthonoplastes* was found associated with almost all species of the red algae present on *Avicennia marina*. *C. leibleiniae* was the only epiphytic Cyanophyceae present on both mangrove trees considered in this survey. Only *Chamaecalyx leibleiniae, Chroococcus minor, Oscillatoria jenensis* and *Calothrix crustacea* were growing on *Ceriops tagal*. *Chamaecalyx leibleiniae* was found associated with *Caloglossa* sp. and *Chroococcus minor* with *Calothrix crustacea*. *O. jenensis* and *C. crustacea* were epiphytic only on the bark of *Ceriops tagal*, and never on macroalgae (Table 1).

Lambert *et al.* (1989) found 27 species of Cyanophyceae (Table 2) on mangroves on the south-east coast of South Africa, of which five are also present at Inhaca Island, namely: *Calothrix scopulorum, Hydrococcus rivularis,*

TABLE 3.—Substrata upon which common species of Cyanophyceae were found growing on mangrove swamps from the southern coast of South Africa and Inhaca Island

Taxon	Substrata									
	M	A	B	R	Bo	C	G	Mu	E	Rh
Calothrix scopulorum					*	*		+	*	*
Hydrococcus rivularis					*+	*	+	+	*	*
Lyngbya confervoides	*	*+	*							
Microcoleus chthonoplastes	*	*+	*	*	+	+	+			
Xenococcus acervatus					*+	*	+		*	*

* according to Lambert *et al*. 1989; + Inhaca Island; A, *Avicennia marina*; B, *Bruguiera gymnorrhiza*; Bo, *Bostrychia* spp.; C, *Caloglossa* sp.; E, *Enteromorpha* sp.; G, *Gelidium* sp.; M, mud; Mu, *Murrayella* sp.; R, *Rhizophora mucronata*; Rh, *Rhizoclonium* sp.

Lyngbya confervoides, Microcoleus chthonoplastes and *Xenococcus acervatus*. Substrata upon which these common species were found show some similarity in both regions (Table 3). This flora consists mainly of non-heterocystous forms (88,2%), which compares well with the number found in southern Africa (85,2%; according to Lambert *et al*. 1989).

The results obtained in this survey show the diversity of species of Cyanophyceae associated with *Avicennia marina* and *Ceriops tagal* in mangroves at Inhaca Island, as follows: seven species of Chroococcales (one Microcystaceae, two Chroococcaceae, two Chamaesiphonaceae, one Hydrococcaceae and one Xenococcaceae), six species of Oscillatoriales (four Oscillatoriaceae and two Phormidiaceae) and three species of Nostocales (one Nostocaceae and two Rivulariaceae).

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Notes on African plants

VARIOUS AUTHORS

LILIACEAE (ASPHODELACEAE)

THE TYPE SPECIMEN OF *ALOE SOUTPANSBERGENSIS*

Verdoorn (1961) cited the type specimen of her new species *Aloe soutpansbergensis* in the protologue as *Crundall s.n. in PRE 29005.* A diligent search, undertaken in the National Herbarium, Pretoria, in connection with our revision of the southern African species of *Aloe*, failed to reveal a specimen with this number.

A specimen, *Crundall s.n. in PRE 27035*, was found among the sheets of *A. soutpansbergensis*, however. It was collected in 1942, the year in which Verdoorn stated that her species was discovered, and was marked 'Figured for *Flowering Plants of South Africa*'. One would expect this annotation on the missing specimen, as the protologue was published in that journal and, of course, included a coloured illustration. Furthermore, the position of the leaves and flowers on the specimen (Figure 1) closely matches the published plate (Figure 2). Is it possible that by some error the specimen on which the plate was based, was registered twice, but the second number was not attached to the specimen?

FIGURE 1.—The earliest specimen of *Aloe soutpansbergensis* Verdoorn. Evidence is presented in this paper for regarding this specimen as the type.

FIGURE 2.—The plate of *Aloe soutpansbergensis* Verdoorn published in the protologue.

The PRE register suggests that this was indeed the case, as the same details are recorded under both no. *27035* and *29005.* Complicating the issue is another Crundall specimen of the same species from the same place, registered as no. *37735.* This, however, was not figured and seems to be somewhat later than the other two.

We believe that the original painting of the plant holds the key to this puzzle. The outer cover bears the expected

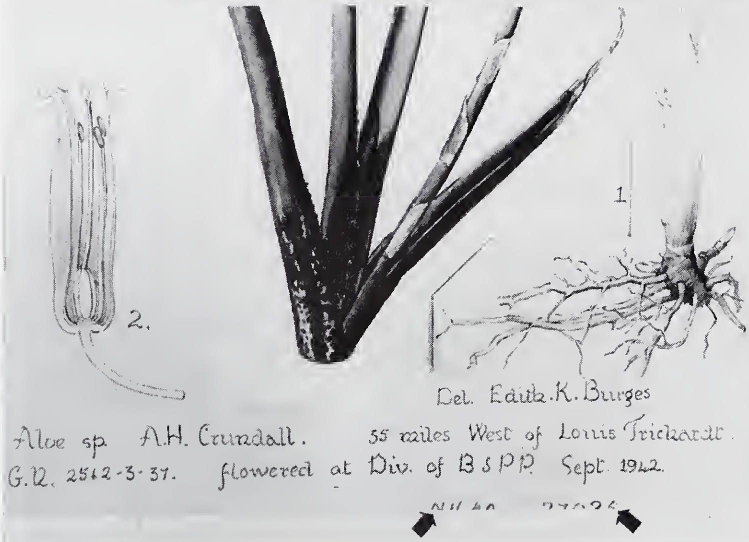

FIGURE 3.—Annotations on the original of Figure 2. The crucial number has been cut through at the bottom (arrowed).

number, *29005* (Figure 4), but at the bottom of the picture itself is a cut-away note which we consider should be interpreted as '*N.H. No. 27035*' (Figure 3). Unfortunately, not enough survives of this note for the handwriting to be identified positively.

It seems, therefore, that for some now irretrievable reason, in the almost 20 years between the time the illustration was made and the plant described, the specimen was entered into the PRE register twice, with one number being marked on the herbarium sheet and the other cited in the protologue. In our opinion, the type specimen of *Aloe soutpansbergensis* Verdoorn is that shown in Figure 1, and its correct citation is:

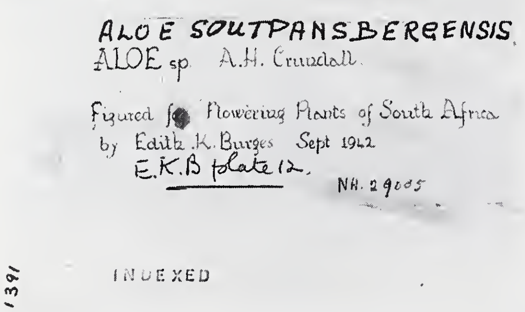

FIGURE 4.—Label on the outer cover of the original of Figure 2.

TYPE.—Transvaal, Zoutpansberg, 1942, *A.H. Crundall s.n. in PRE 27035 (= PRE 29005)* (PRE, holo.!).

We wish to thank Drs O.A. Leistner and D.J.B. Killick for discussing this problem with us, Mrs E. Potgieter for access to the relevant volume of the PRE register, Miss G.S. Condy for access to the original painting, and Mrs A. Romanowski for preparing the photographs for this note.

REFERENCE

VERDOORN, I.C. 1961. *Aloe soutpansbergensis. The Flowering Plants of Africa* 35: t. 1391.

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FABACEAE

CAESALPINIA BRACTEATA, A NEW SPECIES FROM THE ONSEEPKANS AREA OF THE NORTHERN CAPE PROVINCE

Caesalpinia bracteata *Germishuizen*, sp. nov., *C. rostratae* N.E. Br. affinis, sed sepalo inferiori non rostrato, rhachidi sine stipellis subulatis differt.

Frutex vel arbor parva. *Caulis* aculeis dispersis armatus. *Folia* bipinnata; foliolis anguste oblongis vel oblongo-ellipticis, 3–11 × 2–5 mm. *Flores* rosei. *Petala* obovata, usque ad 12 × 8 mm. *Fructus* late oblongus, 15–22 × 10–15 mm.

TYPE.—2819 (Ariamsvlei): Kenhardt District, on farm Skroef, near hot spring (Warmbad Noord) on Orange River, (–DA), 1987-09-29, *Van Hoepen 1941* (PRE, holo.; iso.).

A striking, multi-stemmed shrub or small tree, usually 1,5–2,0 m, but occasionally up to 4 m tall. *Young stems* reddish brown, puberulous or densely appressed pubescent, becoming glabrous with age and peeling off in thin flakes, armed with scattered, almost straight and spreading or slightly curved prickles up to 11 mm long. *Leaves* bipinnate; pinnae 2–4 pairs; leaflets 4–6 (8) pairs per pinna, opposite to subopposite, narrowly oblong or oblong-elliptic, 3–11 × 2–5 mm, rounded at apex and mucronate, asymmetric basally, olive green, glabrous or sparingly puberulous on both surfaces or only along the midrib, densely dark gland-dotted on both surfaces; petiole sparingly puberulous, 4–16 mm long; rhachis sparingly puberulous, often prickly at intersection of pinnae pairs. *Inflorescence* a lateral simple raceme up to 60 mm long. *Bracts* conspicuous, purple pink, densely appressed pubescent, broadly suborbicular, aristate with a sharp brown arista, deciduous as flowers open. *Flowers* hermaphrodite, purple pink. *Sepals* 5, dark maroon, conspicuously veined on inside, densely grey appressed pubescent, gland-dotted outside, the lower sepal larger and cucullate, forming a hood over the other sepals. *Petals* 5, free to base, obovate, up to 12 mm long and 8 mm wide, glabrous or slightly puberulous on outside. *Stamens* 10, up to 10 mm long; filaments pink, white villous for two-thirds from base, glabrous in upper third; anthers brown, dorsifixed, up to 1,5 mm long. *Ovary* glabrous. *Pods* compressed, broadly oblong ovoid, beaked, 15–22 × 10–15 mm, maroon-brown, hard and woody, glabrous. *Seeds* more or less obovoid, maroon-brown. Figure 5.

CAPE.—2819 (Ariamsvlei): Kenhardt District, in hills between Yas and Warmbad Noord, (–DA), 1982-06-08, *Gubb s.n. KMG 10984* (KMG, PRE); on Farm Skroef, near hot spring (Warmbad Noord) on Orange River, 1987-09-29, *Van Hoepen 1941* (PRE); on Farm Skroef, small valleys near Orange River, 1990-07-10, *Van Hoepen 2018* (PRE). Figure 6.

FIGURE 5.—Holotype (*Van Hoepen 1941*) of *Caesalpinia bracteata* housed at PRE. Photograph by A. Romanowski.

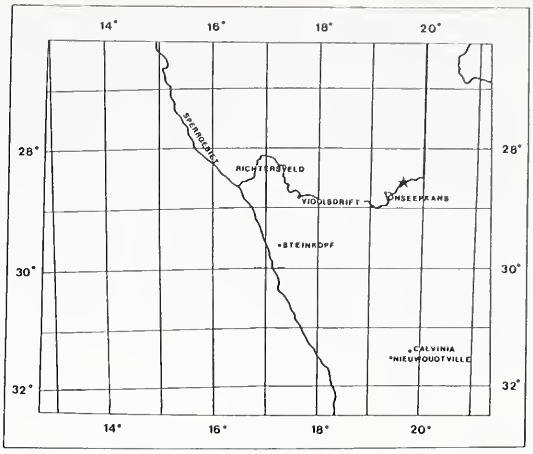

FIGURE 6.—Distribution of *Caesalpinia bracteata* in the northern Cape Province.

Caesalpinia bracteata is endemic to the Warmbad Noord area in the northern Cape Province. Found mainly on small sandy valley floors at sides of valley running down to the river, but also found on rocky ridges. At the beginning of September 1987, 40 mm of rain fell in this area and at the end of April 1990, 104 mm were recorded, followed by one or two smaller showers during May and June. The veld was therefore in good condition and *Caesalpinia bracteata* shrubs were common. At the end of September 1987, Mrs E. Van Hoepen found that most of the shrubs were in full flower while during July 1990 practically all bushes had dead branches but also showed vigorous new shoots. Many bushes had buds at the tips of branches, with an occasional open pink flower in the inflorescence. A few pods were found but most of the seeds were parasitized.

C. bracteata has so far been found only in the north-western part of the Farm Skroef (Figure 6). It is much more rugged and broken than the south-eastern half of the farm, and different from the adjoining Farms Raap-en-Skraap and Steyerkraal. Mr A. Gubb probably collected his specimen on the boundary between Skroef and Yas. These two farms are separated by two parallel ranges of hills running in a straight line along the farm boundary to the river. Skroef's river frontage is about 10 km long.

Mr Jaap Oosthuizen, who grew up on a farm below Aughrabies and now runs a nursery at Aughrabies, knows the plants and veld very well. He visited the farm when *C. bracteata* was in flower, and said that he had never seen it before.

The specific epithet *bracteata* is the Latin for 'having conspicuous bracts'. The bracts of *C. bracteata* are conspicuous but they are deciduous and fall off as soon as the flowers open.

Caesalpinia bracteata and *C. rostrata* closely resemble each other, but differ from one another in a number of morphological characters (see Table 1) and distribution: *C. rostrata* occurs in southern Mozambique and the north-eastern Transvaal, about 1 000 km from *C. bracteata*.

TABLE 1.—Comparison of morphological characters in *Caesalpinia bracteata* and *C. rostrata*

Morphological characters	*C. rostrata*	*C. bracteata*
pinnae pairs	3–7	2–4
leaflet pairs/pinna	6–11	4–6(8)
subulate stipellae on rhachis	present	absent
rostrate beak on lower sepal	present	absent
stamen length (mm)	12	10
fruit colour	brown	maroon-brown
fruit length (mm)	27–32	15–22
fruit width (mm)	16–21	10–15

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MS. received: 1991-03-04.

LICHENES

TWO NEW SPECIES IN THE AGYRIACEAE (LICHENIZED ASCOMYCOTINA, LECANORALES) FROM SOUTHERN AFRICA

Trapelia rediviva *Brusse*, sp. nov.

Thallus crustosus, saxicola, usque ad 75 mm diametro, rimoso-areolatus. *Thallus superne* hebetatus, laevis, violaceo-cinereus, sorediis isidiisque destitutus. *Cortex superior* 9–14 μm crassus, paraplectenchymatus, cellulis 3,0–4,5 μm diametro. *Stratum gonidiale* 30–50 μm crassum, algis viridibus, coccoideis, 4,5–12,0 μm diametro. *Medulla* alba. *Apothecia* adnata, usque ad 1 mm diametris, discis rosescentibus vel carneis, marginibus furfuraceis, albidis, interdum evanescentibus. *Excipulum thallinum* 20–40 μm crassum, madefactum atrogriseum ob aerem inretitum, post purgationem stramineum, paraplectenchymatum, cellulis 3–7 μm diametro. *Excipulum proprium* reductum, hyalinum, 8–10 μm crassum. *Hypothecium* hyalinum, 15–30 μm crassum. *Hymenium* hyalinum, 110–135 μm crassum, J (perdilutum) + pallide caeruleum. *Asci* clavati, tholis J (perdilutis) + perpallide caeruleis vel hyalinis (Figura 7). *Ascosporae* octonae, hyalinae, simplices, ellipsoideae, guttulatae, non halonatae, 22,0–33,5 × 12–20 μm. *Pycnidia* hyalina, globosa, circa 100 μm diametro. *Pycnidiosporae* hyalinae, aciculares, rectae, 21,0–28,5 × 0,5–0,7 μm. *Thallus* acidum gyrophoricum continens.

TYPUS.—Qwaqwa, 2828 (Bethlehem): 33 km S of Phuthaditjhaba, on path to Mont-aux-Sources via chain ladder. Western slopes of the Sentinel. On basalt outcrops with steep to vertical W faces, alt. 2 800 m, (–DB), *F. Brusse 5738*, 1990-04-15 (PRE, holo.; BM, iso.). Figure 8.

Thallus crustose, saxicolous, up to 75 mm across, rimose-areolate. *Upper surface* matt, smooth, mauvish grey, not sorediate and not isidiate. *Upper cortex* 9–14 μm thick, paraplectenchymatous, cells 3,0–4,5 μm diam. *Algal layer* 30–50 μm thick, algae green, coccoid, 4,5–12,0 μm diam. *Medulla* white. *Apothecia* adnate, up to 1 mm across, disc pinkish or flesh-coloured, margins whitish scurfy, sometimes evanescent. *Thalline exciple* 20–40 μm thick, dark grey when wet due to trapped air, stramineous on clearing (with ethanol), paraplectenchymatous, cells 3–7 μm diam. *Proper exciple* reduced, hyaline, 8–10 μm thick. *Hypothecium* hyaline, 15–30 μm thick. *Hymenium* hyaline, 110–135 μm thick, J (very dilute) + pale blue. *Asci* clavate, eight-spored, tholus J (very dilute) + very pale blue or hyaline (Figure 7). *Ascospores* hyaline, simple, ellipsoid, guttulate, non-halonate, 22,0–33,5 × 12–20 μm. *Pycnidia* hyaline, globose, about 100 μm diam. *Pycnidiospores* hyaline, straight needles, 21,0–28,5 × 0,5–0,7 μm. *Chemistry*: gyrophoric acid present.

Trapelia rediviva is similar to *Trapelia mooreana* (Carroll) P. James, and also contains gyrophoric acid, but the discs are pinkish in colour and not brown as in *T. mooreana*. The pycnidiospores are also much longer (21,0–28,5 μm) than those of *T. mooreana* (5–14 μm; Hertel 1977). *Trapelia coarctata* (Turn.) Choisy is also similar and contains gyrophoric acid, but this lichen also has brown apothecial discs, and a poorly developed thallus. Unfortunately the pycnidia of this lichen have never been found (Hertel 1977), an observation supported by my examination of a few specimens of *T. coarctata*.

Trapelia chiodectonoides Brusse is similar in thalline characters to *T. rediviva*, and is from a fairly nearby locality. However, *T. chiodectonoides* is a peculiar lichen with clustered apothecia and halonate ascospores (checked by negative staining with indian ink water). The hypothecium is also much thicker (40–100 μm) than that of *T. rediviva* (15–30 μm), and the ascospores are distinctly smaller (16–21 × 8,0–10,5 μm) than those of *T. rediviva* (22,0–33,5 × 12–20 μm).

The chemistry of this species, gyrophoric acid, is very common in this genus, and in the closely related *Trapeliopsis* (Coppins & James 1984; Hertel & Leuckert 1969; Schneider 1980). Thus far, this new species is known only from the type locality, the vicinity of Mont-aux-Sources in the northern Drakensberg.

Trapeliopsis parilis *Brusse*, sp. nov.

Thallus squamulosus, terricola, usque ad 50 mm diametro. *Lobi* elongati, 0,4–1,0 mm lati, 130–160 μm crassi, discreti. *Thallus superne* albidus, furfuraceus, hebetatus, marginibus avellaneis vel mellinis. *Stratum epinecrale* 10–25 μm crassum, mox solvens. *Cortex superior*

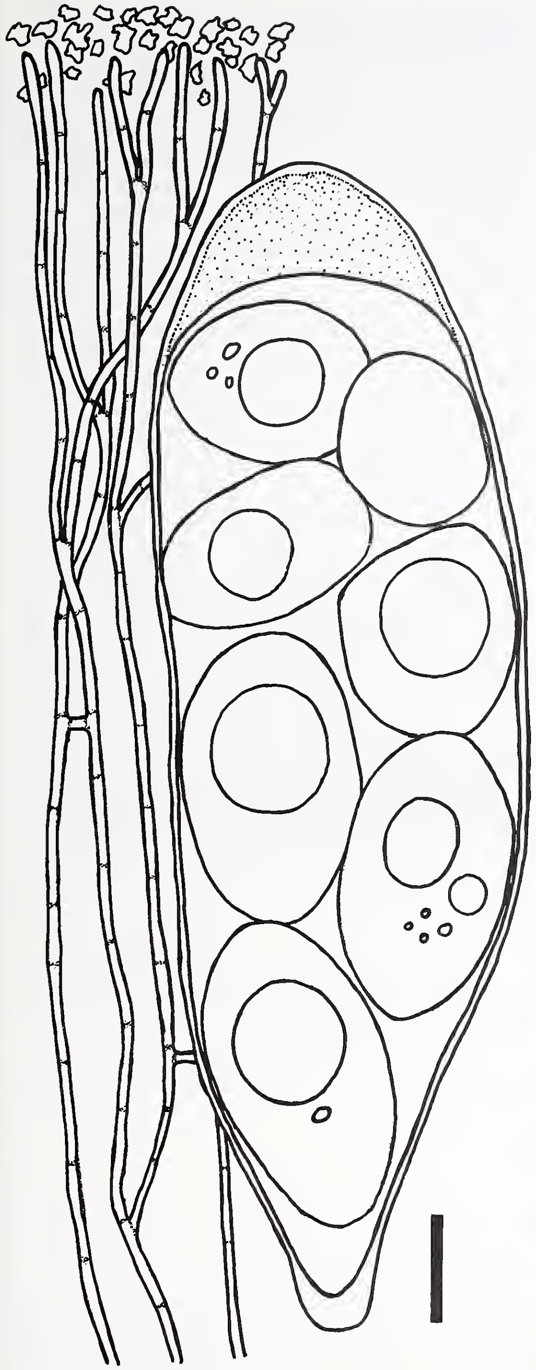

FIGURE 7.—*Trapelia rediviva*, ascus and paraphyses. *F. Brusse 5738*, holotype. Bar = 10 μm.

paraplectenchymatus, 20–35 μm crassus, cellulis 3,5–8,0 μm diametro. *Stratum gonidiale* 35–50 μm crassum, algis viridibus, coccoideis, 3,5–9,0 μm diametro. *Medulla* alba, 50–90 μm crassa. *Cortex inferior* non bene evolutus. *Apothecia* adnata, usque ad 0,8 mm diametro, discis concavis, atro-brunneis, marginibus albidis, furfuraceis. *Excipulum thallinum* (solum cortice) 40–60 μm crassum, paraplectenchymatum, cellulis 4,0–12,5 μm diametro. *Excipulum proprium* reductum, 10–25 μm crassum. *Hypothecium* hyalinum, usque ad 85 μm crassum. *Hymenium* hyalinum, J (perdilutum) + pallide caeruleum, 65–90 μm crassum. *Asci* clavati, tholis J (perdilutis) + pallide caeruleis vel hyalinis (Figura 9). *Ascosporae* octonae, hyalinae simplices, ellipsoideae, saepe guttulatae, non halonatae, 11,5–16,5 × 4,5–7,0 μm. *Pycnidia* (in typo non visa) hyalina, globosa, circa 100 μm diametro. *Pycnidiosporae* hyalinae, rectae, aciculares, 17–29 × 0,7 μm. *Thallus* acidum gyrophoricum continens.

TYPUS.—Transvaal, 2528 (Pretoria): 2 km from the Balmoral interchange to Pretoria on the Witbank–Pretoria highway. Farm Eenzaamheid 534 JR. On soil near granite pavements on SW slope, with some seasonal water trickling. Alt. 1 500 m (–DD), *F. Brusse 5786*, 1990-07-03 (PRE, holo.; BM, COLO, LD, iso.). Figure 10.

Thallus squamulose, terricolous, up to 50 mm across. *Lobes* elongate, 0,4–1,0 mm wide, 130–160 μm thick, discrete. *Upper surface* whitish, scurfy, matt; margins tan. *Epinecral layer* 10–25 μm thick, soon disintegrating. *Upper cortex* paraplectenchymatous, 20–35 μm thick, cells 3,5–8,0 μm diam. *Algal layer* 35–50 μm thick; algae green, coccoid, 3,5–9,0 μm diam. *Medulla* white, 50–90 μm thick. *Lower cortex* not well developed. *Apothecia* adnate, up to 0,8 mm across; disc concave, dark brown; margins whitish, scurfy. *Thalline exciple* (cortex only) 40–60 μm thick, paraplectenchymatous, cells 4,0–12,5 μm diam. *Proper exciple* reduced, 10–25 μm thick. *Hypothecium* hyaline, up to 85 μm thick. *Hymenium* hyaline, J (very dilute) + pale blue, 65–90 μm thick. *Asci* clavate, eight-spored, tholus J (very dilute) + pale blue to hyaline (Figure 9). *Ascospores* hyaline, simple, ellipsoid, often guttulate, not halonate, 11,5–16,5 × 4,5–7,0 μm. *Pycnidia* (not seen in type) hyaline, globose, about 100 μm diam. *Pycnidiospores* hyaline, straight needles, 17–29 × 0,7 μm. *Chemistry*: gyrophoric acid present.

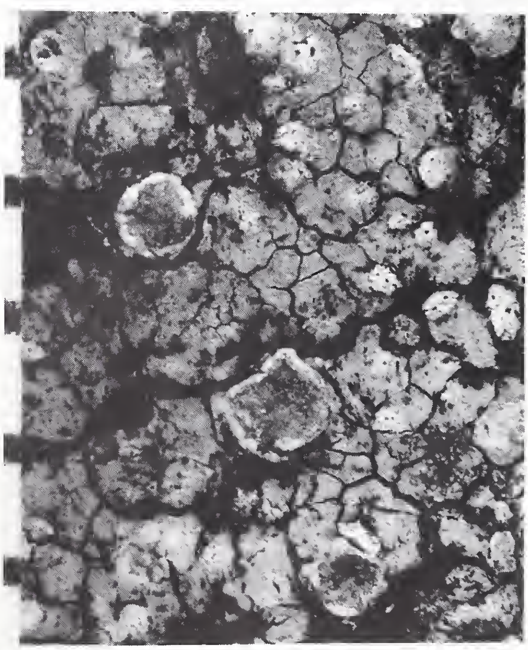

FIGURE 8.—*Trapelia rediviva*, habit. *F. Brusse 5738*, holotype. Scale in mm.

This new species may be compared to *Trapeliopsis wallrothii* (Flörke) Hertel & G. Schneider with a similar ascospore size range and chemistry. However, *T. parilis* lacks the peltate dactyls present in *T. wallrothii* (Coppins & James 1984) and has smaller, more concave apothecia. The pycnidiospores of *T. parilis* are also much longer (17–29 μm) than those of *T. wallrothii* (6–10 μm).

Many other *Trapeliopsis* species are K + yellow or red with unknown substances present (Hertel 1969, 1970, 1981; Schneider 1980).

Pycnidia were unfortunately not found on the type material of this species, but were found on both paratypes.

This new species appears to be fairly widespread, at least at medium altitudes, on the eastern side of southern Africa, and has been verified from the Transvaal and Natal. The species appears to be restricted to soil where it is at least seasonally damp due to ground water reaching the surface, but has not been found in fully-fledged seepage flows.

TRANSVAAL.—2529 (Witbank): Middelburg, 2 km N of town centre at bridge over the Little Olifants River, on road to Loskop Dam. On brown soil on a slight Waterberg Sandstone exposure, in grassy terrain (now a landscaped lawn and no longer present). Alt. 1 445 m, (–CD), *F. Brusse 1314*, 1981-03-27 (PRE).

NATAL.—2930 (Pietermaritzburg): 9 km from Mooi River to Rosetta. On black soil in full sun, (–AA), *O.H. Volk 84-634*, 1984-01-13 (PRE).

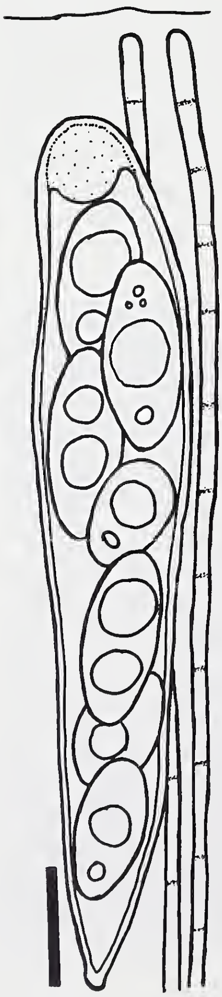

FIGURE 9.—*Trapeliopsis parilis*, ascus and paraphyses. *F. Brusse 5786*, holotype. Bar = 10 μm.

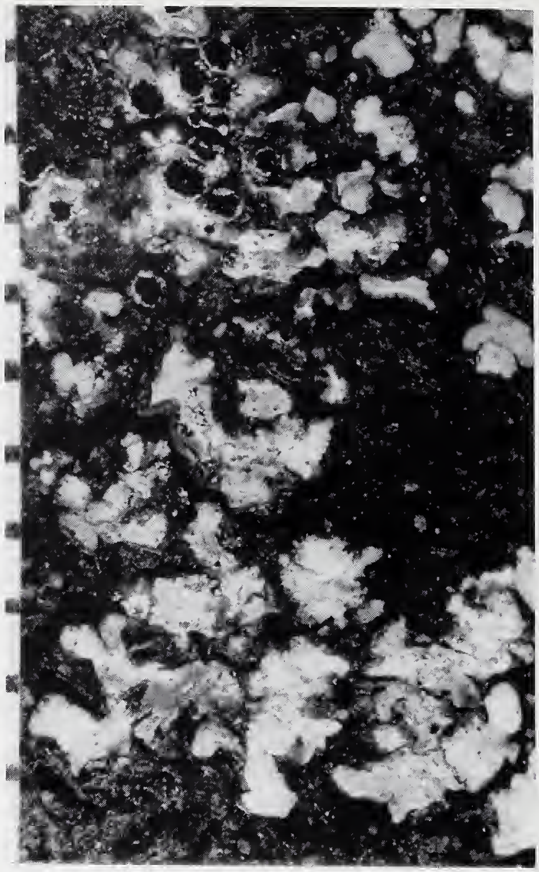

FIGURE 10.—*Trapeliopsis parilis*, habit. *F. Brusse 5786*, holotype. Scale in mm.

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LILIACEAE

NOTES ON SOME MONOCOTYLEDONEAE DESCRIBED BY N.L. BURMAN: ASPARAGACEAE, ASPHODELACEAE, COLCHICACEAE

Burman published the *Prodromus florae capensis* as an appendix to his *Flora Indica*. The book was published in March & April 1768, later than Bergius' *Descriptiones plantarum capitis bonae spei* and Linnaeus' *Mantissa plantarum*, but just before Miller's *Gardeners' Dictionary* which appeared in May 1768.

Burman's publication has not been fully analysed and many of his names may well threaten current names of South African plants. A project to study Burman's *Prodromus* in detail has been initiated at the AETFAT Congress at Zomba, Malawi. H.P. Linder, Bolus Herbarium, will co-ordinate the project in South Africa and D.O. Wijnands, Wageningen Botanical Gardens, will do so in Europe.

In view of the forthcoming publication of the revision of Asparagaceae by Mrs A.A. Obermeyer Mauve in the *Flora of southern Africa*, Burman's new names in *Asparagus* are discussed here. Also new combinations in *Bulbine* and in *Onixotis* are proposed.

Protasparagus lignosus *(N.L. Burman) Obermeyer*, comb. nov. *Asparagus lignosus* N.L. Burman, Prodromus florae capensis: 10 (1768). Lectotype in G-Burman.

Asparagus compactus Salter in Journal of South African Botany 6: 165 (1940). *Protasparagus compactus* (Salter) Obermeyer in South African Journal of Botany 2: 243 (1983). Holotype: *Wolley Dod 2521* (BOL).

Protasparagus capensis *(L.) Obermeyer.*

Asparagus triacanthus N.L. Burman, Prodromus florae capensis: 10 (1768) syn. nov. Lectotype in G-Burman, left hand specimen.

Protasparagus rubicundus *(Bergius) Obermeyer.*

Asparagus ruber N.L. Burman, Prodromus florae capensis: 10 (1768), syn. nov. Lectotype in G-Burman.

Asparagus planiusculus *N.L. Burman*, Prodromus florae capensis: 10 (1768). No specimen which could typify this name has been traced in G-Burman.

Bulbine cepacea *(N.L. Burman) Wijnands*, comb. nov. *Ornithogalum cepaceum* N.L. Burman, Prodromus florae capensis: 10 (March & April 1768). *Ornithogalum tuberosum* Miller, Gardeners' Dictionary edn 8, *Ornithogalum* No. 10, (1768, May). *Bulbine tuberosa* (Miller) Obermeyer in Bothalia 12: 62 (1976). Holotype: Hermann, Horti academici Lugduno-Batavi catalogus: t. 467 (1687).

Onixotis stricta *(N.L. Burman) Wijnands*, comb. nov. *Pontederia stricta* N.L. Burman, Prodromus florae capensis: 9 (1768). Lectotype in G-Burman, possibly collected by J.A. Auge.

Anthericum bulbine Houttuyn, Natuurlijke Historie II, 14: 353 [aanw. 2] Tab. 80 fig. 3, 1780, syn. nov.. Holotype in G-Houttuyn, the specimen illustrated in Tab. 80 fig. 3, probably collected by J.A. Auge.

Melanthium triquetrum L.f., Supplementum plantarum: 213 (1782). *Dipidax triquetra* (L.f.) Baker in Journal of the Linnean Society 17: 446 (1879). *Onixotis triquetra* (L.f.) Mabberley in Taxon 29: 600 (1980). Syntypes: Thunberg, *UPS-Thunberg 8959, 8960.*

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GERANIACEAE

THE CORRECT AUTHOR CITATION FOR *PELARGONIUM* SECTION *CORTUSINA*

In the last revision of the genus *Pelargonium* L'Hérit. (Geraniaceae), Knuth (1912) cited De Candolle as the author of the section *Cortusina*. The same author citation was used by Van der Walt & Vorster (1988). A detailed revision of the section *Cortusina*, however, revealed that this is not entirely correct.

The name *Cortusina* was first published by De Candolle (1824), but he applied it to a subseries of the series *Isopetaloîedae* DC. in his section *Pelargium* DC. Harvey (1860) was the first author to raise the name *Cortusina* to sectional level when he described *Cortusina* as the 14th of 15 sections recognized by him.

The correct author citation should therefore be *Pelargonium* sect. *Cortusina* (DC.) Harv.

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ASTERACEAE

NEW SPECIES IN THE GENUS *DISPARAGO*

INTRODUCTION

The previous revision of the genus (Levyns 1936) dealt with seven species, of which six are retained. Miss E. Esterhuysen has since made a major contribution to the genus by collecting three new species from remote areas in the high mountains of the Worcester Division in the south-western Cape. These three species bring a whole new dimension to the genus in that they possess the plesiomorphic characters of the genus (Koekemoer in prep.). They also reduce the taxonomic distance between *Disparago* and the very closely related monotypic genus *Bryomorphe* Harv., which is only found in high altitude fynbos on Table Mountain Sandstone.

All three new species are confined to high altitudes, have white female ray flowers with fertile cypselas, purple-red male tubular flowers with sterile cypselas and heads with two or three ray flowers and three to five tubular flowers. These characters distinguish the new species very clearly from the other six.

Disparago gongylodes *Koekemoer*, sp. nov., *D. pilosae* Koekemoer et *D. barbatae* Koekemoer similis sed foliis gongylodibus distinguitur. *Folia* ovata, gongylodes, prope basin ad angulum 180° torta. *Flosculi radii* albi foeminei. *Flosculi tubulares* masculi cypselis sterilibus. *Pappus* pilis 2–3 plumosis caducis.

TYPE.—Cape Province, 3319 (Porterville): Great Winterhoek Reserve, *Esterhuysen 35788*, (BOL, holo.; K, NBG, PRE (2x), S, STE, iso.). (Figure 11).

Small shrublets, (50–)100–350 mm tall, much branched; branches spreading, often trailing in very old plants. *Leaves* ovate, 2,5–3,5(–5,0) × 1–2 mm (including pedicel), spreading horizontally, twisted 180° near the base, margins slightly inrolled, woolly-hairy adaxial surface clearly visible, apex blunt. *Inflorescence* with 5–12 heads loosely grouped. *Heads* with 2 ray flowers and 5 tubular flowers. *Involucre* of about 12 bracts roughly arranged in about 3 whorls, those in outer whorl fleshy, other bracts chaffy, innermost ones linear, others broadly cymbiform, dark brown to black, often tinged red in upper half, margins undulate, tips reflexed. *Ray flowers* female, white, limb 3–4 × 1,5–2,5 mm; cypselas fertile, densely hairy. *Tubular flowers* functionally male, purple-red; stamens often reduced, appearing club-shaped in some flowers; cypselas sterile, short-haired. *Pappus* of 2 or 3 plumose hairs, caducous, cilia in the upper part of the pappus with tips rounded, inflated and lightly fused.

Distribution and habitat

The only known records of this species are from the Great Winterhoek Mountains near Porterville (Figure 12). In this area it is, however, very common on large open flats on coarse Table Mountain Sandstone where small Restionaceae species are dominant. These flat areas are usually at the foot of weathered sandstone hills, described as 'rugged koppies' by Miss Esterhuysen on the type label.

Specimens examined

CAPE.—3319 (Porterville): Great Winterhoek Reserve, (–AA), 1978-01-02, *Esterhuysen 34840* (BOL, PRE); Twentyfour Rivers Mountains, (–AA), 1953-10-10, *Esterhuysen 21894* (BOL, PRE); Great Winterhoek Reserve, (–AA), 1982-08-15, *Esterhuysen 35788* (BOL, K, NBG, STE); Great Winterhoek Mountains, Farm Berghof, (–AA), 1989-10-08, *Koekemoer 315* (PRE); Great Winterhoek Wilderness Area, 2 km from entrance gate at Zuurvlakte, (–AA), 1990-09-12, *Koekemoer 439* (PRE); Great Winterhoek Mountains, Farm Berghof, (–AA), 1990-09-12, *Koekemoer 440* (PRE).

The specific epithet refers to the knob-like leaves which are unique in the genus.

Disparago barbata *Koekemoer*, sp. nov., *D. gongylodi* Koekemoer et *D. pilosae* Koekemoer similis, sed foliis linearibus patentibus pappoque barbato distinguitur. *Folia* lineares, torsiva, horizontaliter patentes. *Flosculi radii* albi foeminei cypselibus fertilibus. *Flosculi tubulares* masculi cypselibus sterilibus. *Pappus* pilis 2–3 barbellatis caducis.

TYPE.—Cape Province, 3319 (Worcester): (Matroosberg), SE slopes, *Esterhuysen 28615* (BOL 48345, holo.; BOL 48346, PRE, S, iso.) (Figure 13).

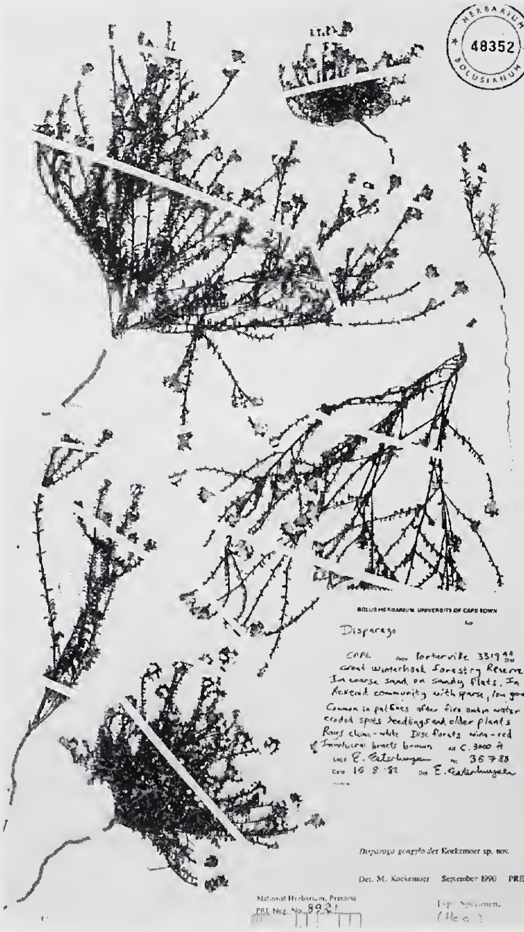

FIGURE 11.—Photograph of the holotype of *Disparago gongylodes*.

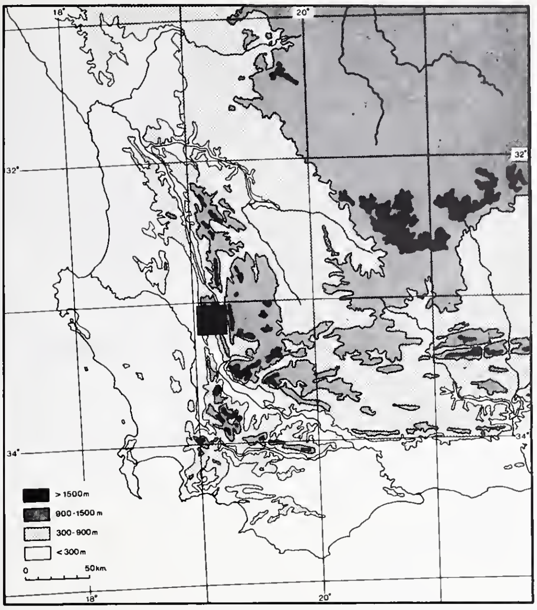

FIGURE 12.—Geographical distribution of *Disparago gongylodes*.

FIGURE 13.—Photograph of the holotype of *Disparago barbata*.

Trailing shrublet, 200–400 mm tall. *Leaves* narrow, linear, ericoid, 4–9 × 0,5–0,8 mm, spreading, spirally twisted (mostly only 180°), tips acuminate. *Inflorescence* with numerous heads in a tight, ovoid , secondary arrangement, 10–15 mm in diameter. *Heads* with 3 ray flowers and 3 tubular flowers. *Involucre* of about 12 bracts in 3 whorls, bracts narrowly cymbiform, 4,5–6,0 × 0,6–1,3 mm, with few long hairs on adaxial surface, margins entire, apex narrow, apiculate, often reflexed, usually yellowish at base, reddish in middle and dark brown near apex. *Ray flowers* female, white, limb 2,0–2,5 × ± 1,5 mm; cypselas fertile, dorsiventrally flattened, short-haired. *Tubular flowers* functionally male, purple; cypselas sterile, short-haired. *Pappus* of 2 or 3 barbed bristles, caducous.

Distribution and habitat

The only known localities of this species are on the eastern and south-eastern slopes of Matroosberg in the Worcester District of the south-western Cape (Figure 14).

Specimens examined

CAPE.—3319 (Worcester): Matroosberg, SE slopes, (–BC), 1960-11-13, *Esterhuysen 28615* (BOL, PRE, S); Matroosberg, E slopes above De Doorns, (–BC), 1959-01-16, *Esterhuysen 28119* (BOL).

The specific epithet refers to the barbed pappus, which is unique in the genus.

Disparago pilosa *Koekemoer*, sp. nov., *D. barbatae* Koekemoer et *D. gongylodi* Koekemoer similis sed foliis linearibus adscendentibus, bracteis involucri pilosis atque pappo plumoso coroniformi distinguitur. *Folia* lanceolata, non torsiva. Bracteae involucri pagina adaxiali tomentosa. *Flosculi radii* albi foeminei cypselis fertilibus. *Flosculi tubulares* masculi cypselis sterilibus. *Pappus* pilis ± 10 plumosis basi connatis.

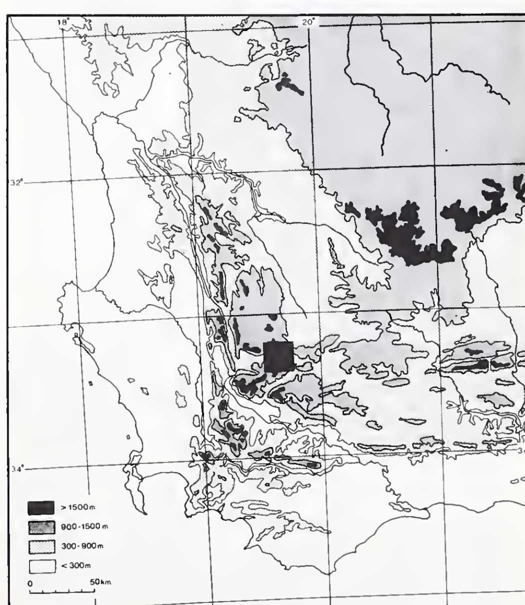

FIGURE 14.—Geographical distribution of *Disparago barbata*.

TYPE.—Cape Province, 3319 (Worcester): Ceres District, Roodeberg, near Matroosberg, N slopes, *Esterhuysen 29721* (BOL 48349, holo.; BOL 48350, NBG, PRE, S, iso.). (Figure 15).

Small shrublets, up to 250 mm tall, much branched; branches hairy or glabrous. *Leaves* not twisted, lanceolate, 2–6 × 0,5–0,9 mm, appressed or spreading slightly, giving an angular appearance to the branches. *Inflorescence* with a few heads loosely grouped. *Heads* with 3 ray flowers and 5 tubular flowers. *Involucre* of 11–13 bracts in about two whorls, outer bracts broadly cymbiform, inner bracts filiform, bracts bicoloured, light brown near base, darker towards apex with a reddish tinge in upper part, lower half of adaxial surface densely hairy, margins undulate, occasionally with a membranous edge, apex apiculate, reflexed. *Ray flowers* female, white, limb 2,5–3,5 × 1,5–2,0 mm; cypselas fertile, short-haired. *Tubular flowers* functionally male, pink, glands often present on lobes; cypselas sterile. *Pappus* of about 10 plumose hairs, fused in a ring at the base.

Distribution and habitat

Disparago pilosa has a very local distribution (Figure 16) in rocky and sandy places on mountains in the Worcester District and in the Cold Bokkeveld.

FIGURE 15.—Photograph of the holotype of *Disparago pilosa*.

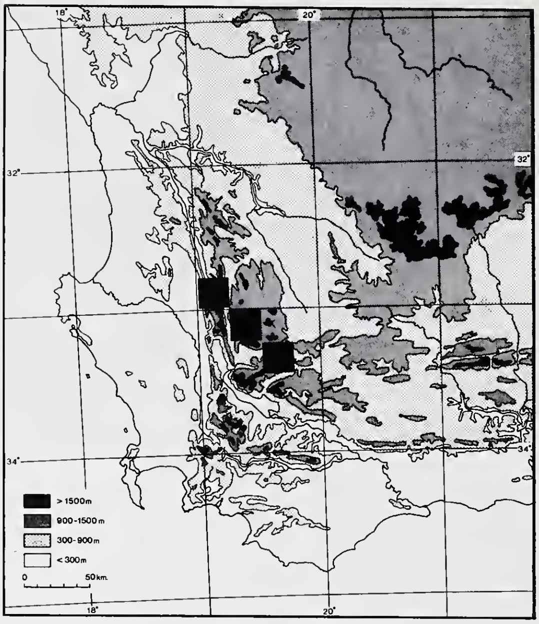

FIGURE 16.—Geographical distribution of *Disparago pilosa*.

Specimens examined

CAPE.—3219 (Clanwilliam): Ceres District, northern base of Roelofsberg, (–CC), 1977-10-08, *Esterhuysen 34675* (BOL, S); Wabooms River, Ceres, Cold Bokkeveld, (–CC), 1966-09-05, *Hanekom 624* (PRE). 3319 (Worcester): Ceres District, Rosendal and Bo-Rosendal, at the foot of Bokkeveld Sneeukop, (–AB), 1975/09/13, *Esterhuysen 33928* (BOL,S); Ceres District, Roodeberg near Matroosberg, N slopes, (–BC), 1962-10-10, *Esterhuysen 29721* (BOL,NBG, PRE, S); Worcester District, Matroosberg, northern plateau, (–BC), 1958-04-07, *Esterhuysen 27704* (BOL); Matroosberg, near top along pipeline, (–BC), 1990-02-01, *Koekemoer 361* (PRE).

The specific epithet refers to the hairy involucre, which is uncommon in the genus.

NAME CHANGES

The following three new synonyms also arose from the study and will be discussed in detail in the synopsis of the genus (Koekemoer in prep.):

Disparago kolbei *(H. Bol.) Hutch.*: 511 (1932).

D. rosea Hutch.: 511 (1932).

Disparago ericoides *(Berg.) Gaertn.*: 463 (1791).

D. lasiocarpa Cass: 42 (1825).

Disparago tortilis *(DC.) Sch. Bip.*: 181 (1861).

D. ericoides auct. non Berg.: Gaertn.: 463 (1791); Cassini: 349 (1819); Levyns: 100 (1836); DC.: 257 (1837); Harv.: 278 (1865); Dyer: t. 1102 (1951).

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POACEAE

ON THE ORIGIN OF *ELEUSINE AFRICANA*

All but one of the known species of the genus *Eleusine* Gaertn. occur in Africa and seven are endemic to that continent (Phillips 1972). In India the genus is represented by only two species: *E. indica* (L.) Gaertn. and *E. coracana* (L.) Gaertn. [*E. compressa* (Forssk.) Christ. was excluded from the genus by Hilu (1981)].

Opinions on the taxonomic position of the taxon under discussion have varied considerably and consequently different names have been assigned to it: *Eleusine africana* K.-O'Byrne (1957), *E. indica* (L.) Gaertn. subsp. *africana* (K.-O'Byrne) S.M. Phillips (1972), and *E. coracana* (L.) Gaertn. subsp. *africana* (K.-O'Byrne) Hilu & De Wet (1976).

Moffet & Hurcombe (1949) were the first to report a tetraploid (2n=4x=36) form of *E. indica* from Africa (cf. Kennedy-O'Byrne 1957). On the basis of morphological characters, especially the length of the lemma, and the different chromosome numbers, Kennedy-O'Byrne (1957) separated this form from the typical diploid (2n=2x=18) *E. indica* and raised it to species rank. The first Indian record of the tetraploid form was from Assam-Shillong (Subramanyam & Kamble 1967). Hiremath (1973) studied a further Indian record of the tetraploid form, collected at Hattaragi, and found that the morphology, karyotype and meiosis fully agreed with the African collections of the tetraploid *E. africana*. More recently Sinha (1983) and Dixit *et al.* (1987) reported *E. africana* from Almora (Uttar Pradesh) and Hoshnabad and Betul region (Madhya Pradesh) respectively. Both Sinha (1983) and Dixit *et al.* (1987) believed the plant to be of Indian origin.

We collected *E. africana* from Hattaragi (Belgaum District, Karnataka State, India) situated on Pune-Bangalore National Highway No. 4 during September–October 1985 (Salimath 1990). It was growing as a weed in cultivated fields, open grasslands and disturbed areas. Mature plants and seeds were collected from naturally growing populations. From the seed collected, plants were raised to maturity in the experimental garden of the Department of Botany, Karnatak University, Dharwad.

The chromosome number was established by studying the meiosis following the method of Chennaveeraiah & Hiremath (1974). The specimens were identified by the Royal Botanic Gardens, Kew, U.K. The 2C nuclear DNA content was estimated in this, as well as a collection from Kenya, using a Vickers M86 Scanning Microdensitometer (Hiremath & Salimath in prep.). Seed morphology of the present Indian collection and a collection from Kenya were studied using a Scanning Electron Microscope. For SEM observation, dry seeds washed in acetone, mounted on double adhesive tape, were coated with gold in a Hitachi HVS-5 GN vacuum coater and finally observed under Hitachi S-450 Scanning Electron Microscope operated at 15 kV. A herbarium specimen has been deposited in the Herbarium, Royal Botanic Gardens, Kew, U.K. and a duplicate is also filed in the Herbarium, Department of Botany, Karnatak University, Dharwad.

The following features of the material were investigated: gross morphology (Figure 17A, B), chromosome number (2n=4x=36), normal meiotic behaviour showing 18 regular bivalents (Figure 17C), tuberculate spermoderm pattern (Figure 18A, B) and 5.11 pg of 2C nuclear DNA content. Material of *E. africana* from Kenya, subjected to the same investigation, gave exactly the same results.

There has been a long-standing debate regarding the origin and evolution of finger millet *E. coracana*. De Candolle (1886), Burkill (1935), Cobley (1956) and Dixit *et al.* (1987) considered it to be an Indian domesticate. Vavilov (1951) proposed an independent origin of finger millet in Africa and India. On the other hand, Mehra (1963), Porteres (1970), Chennaveeraiah & Hiremath (1974) and Hilu & De Wet (1976) considered this crop to be African in origin. Cytogenetic, morphological, phyto-

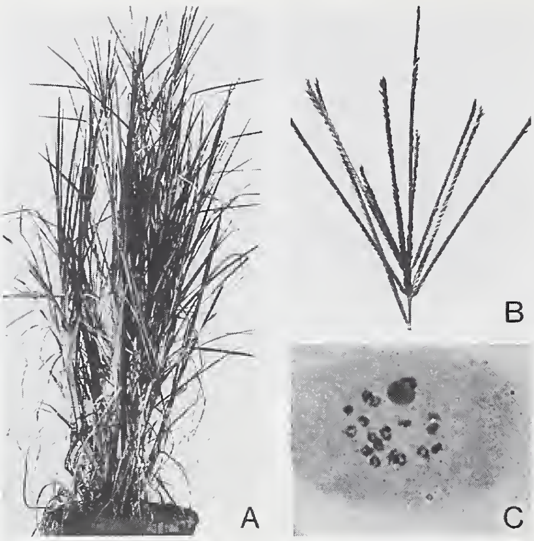

FIGURE 17.—A, potted plant of *E. africana* K.-O'Byrne from Hattaragi, India; B, spike enlarged; C, diakinesis showing 18 bivalents.

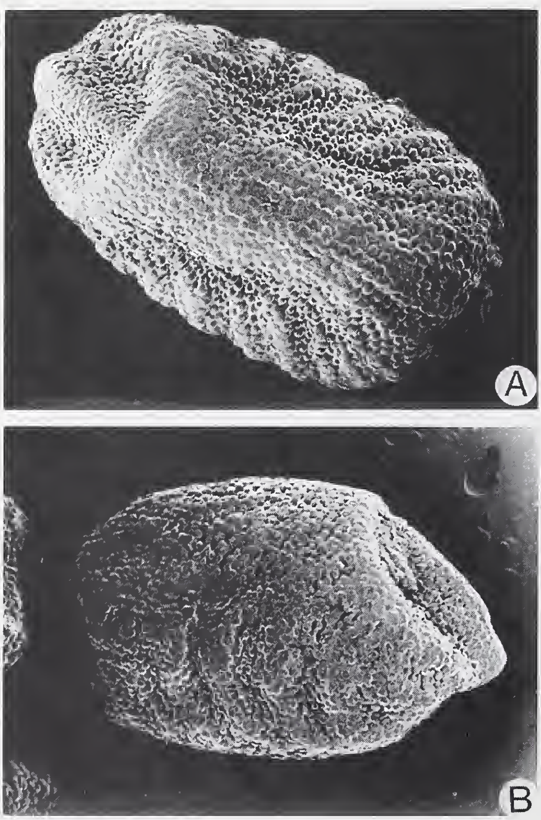

FIGURE 18.—A, tuberculate spermoderm pattern in *E. africana* K.-O'Byrne from Kenya, × 30; B, tuberculate spermoderm pattern in *E. africana* K.-O'Byrne from Hattaragi, India, × 30.

geographical, historical and archaeological studies strongly suggest that *E. africana* is the wild progenitor of *E. coracana* which was domesticated in the highlands of East Africa (Chennaveeraiah & Hiremath 1974; Hilu & De Wet 1976; Hilu *et al.* 1979). Introduction of the crop species, finger millet, from Africa to India is believed to have taken place as early as 3000 B.C. (Hilu & De Wet 1976). Therefore, regarding the occurrence of *E. africana* in India, it appears that it was introduced as a contaminant of imported seed of finger millet. On the other hand, considering the direct origin of finger millet from *E. africana* (Chennaveeraiah & Hiremath 1974), it is possible that in India it might have originated as a reversion from an escaped finger millet. Such evidence is available in the case of *Sorghum bicolor* (L.) Moench. subsp. *arundinaceum* (Desv.) De Wet & Harlan, which arrived in India from Africa by reversion of *S. bicolor* subsp. *bicolor* (Thomas A. Cope, pers. comm.).

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Basic chromosome numbers and polyploid levels in some South African and Australian grasses (Poaceae)

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Keywords: chromosome numbers, meiosis, Poaceae, polyploidy, southern Africa

ABSTRACT

Chromosome numbers of 46 specimens of grasses, involving 24 taxa from South Africa and Australia, have been determined during the present study. For the first time chromosome numbers are given for *Eragrostis sarmentosa* (Thunb.) Trin. (n = 20), *Panicum aequinerve* Nees (n = 18), *Digitaria argyrograpta* (Nees) Stapf (n = 9) and *D. maitlandii* Stapf & C.E. Hubb. (n = 9). Additional polyploid levels are described for *Diplachne fusca* (L.) Beauv. ex Roem. & Schult. (n = 10) and *Digitaria diagonalis* (Nees) Stapf var. *diagonalis* (n = 9).

B-chromosomes were observed in several different specimens. The presence of B-chromosomes often results in abnormal chromosomal behaviour during meiosis.

UITTREKSEL

Chromosoomgetalle van 46 graseksemplare, wat 24 taksons uit Suid-Afrika en Australië behels, is bepaal. Vir die eerste keer word chromosoomgetalle vir *Eragrostis sarmentosa* (Thunb.) Trin. (n = 20), *Panicum aequinerve* Nees (n = 18), *Digitaria argyrograpta* (Nees) Stapf (n = 9) en *D. maitlandii* Stapf & C.E. Hubb. (n = 9) vermeld. Addisionele poliploïede vlakke word ook beskryf vir *Diplachne fusca* (L.) Beauv. ex Roem. & Schult. (n = 10) en *Digitaria diagonalis* (Nees) Stapf var. *diagonalis* (n = 9).

B-chromosome is by verskeie eksemplare waargeneem. Die teenwoordigheid van B-chromosome is dikwels met abnormale meiotiese chromosoomgedrag geassosieer.

INTRODUCTION

Raven (1975) regarded cytogenetics as an important element in the evaluation of relationships and in the determination of phylogenetic sequences in the angiosperms. In South Africa this useful taxonomic tool has not been used widely and plant cytogenetics can be considered to be one of the most neglected fields of botany. Thorough cytogenetic studies are restricted to a few economically important species and the most basic cytogenetic data, the chromosome numbers of the taxa, are not available for the majority of our indigenous species.

In an attempt to increase our cytogenetic knowledge of the South African flora, a cytogenetic study of the family Poaceae was initiated by the Botanical Research Institute during 1986 and is now continued at the National Botanical Institute, the Grassland Research Centre and the Department of Botany and Genetics at the University of the Orange Free State. Results were reported in previous publications in this series (Spies & Du Plessis 1986a, b, 1987a, b, 1988; Spies & Jonker 1987; Spies & Voges 1988; Du Plessis & Spies 1988; Spies *et al*. 1989). The present paper reports on miscellaneous unpublished chromosome numbers and aims to determine whether this information can contribute to our knowledge on the basic chromosome numbers and polyploid levels present in the South African Poaceae.

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MATERIALS AND METHODS

Cytogenetic material was collected in two different ways for the purpose of this study. The material was either collected and fixed in the field, or living material was collected in the field and transplanted in the nursery of the National Botanical Institute, Pretoria, where cytogenetic material was later collected and fixed. The material used and localities of origin are listed in Table 1. Voucher specimens are housed in the National Herbarium, Pretoria (PRE).

Young inflorescences were fixed in Carnoy's fixative (Carnoy 1886). The fixative was replaced by 70% ethanol after 24–48 hours of fixation. Anthers were squashed in aceto-carmine (Darlington & La Cour 1976). Contrast between cytoplasm and chromosomes was enhanced by adding a small droplet of 45% acetic acid, saturated with iron acetate, to the stain immediately prior to making the squash [modification of method used by Thomas (1940)]. Slides were made permanent by freezing them with liquid CO_2 (Bowen 1956), followed by dehydration in ethanol and mounting in Euparal. An Olympus Vanox-S photomicroscope and Ilford Pan-F film were used for the photomicrographs. At least ten cells per specimen were studied for each meiotic stage, except where otherwise indicated.

RESULTS AND DISCUSSION

The haploid chromosome numbers observed are listed with the voucher specimen numbers and their localities in Table 1. The classification of subfamilies and tribes follows Clayton & Renvoize (1986). Unless otherwise indicated, meiotic chromosome behaviour was normal.

TABLE 1.—List of species studied, haploid chromosome numbers, voucher specimen numbers and localities according to the degree reference system (Edwards & Leistner 1971)

Taxon	Haploid chromosome number	Locality and voucher number
Subfamily **Arundinoideae**		
Tribe **Aristideae**		
Aristida congesta subsp. *congesta*	11	NATAL.—2930 (Pietermaritzburg): 5 km from Muden to Greytown, (—BA), *Du Plessis 137.*
Stipagrostis obtusa	22	NAMIBIA.—2616 (Aus): 10 km east of Aus, (—CB), *Spies 2905.*
	22+0—2B	NAMIBIA.—2617 (Bethanie): near bridge over Fish River on road between Seeheim and Luderitz, (—DD), *Spies 2898.*
Subfamily **Chloridoideae**		
Tribe **Eragrostideae**		
Subtribe Eleusininae		
Diplachne fusca	10	CAPE.—3018 (Kamiesberg): 52 km from Springbok to Loeriesfontein, (—AA), *Spies 3373.*
Eragrostis capensis	20	TRANSVAAL.—2430 (Pilgrim's Rest): near Mac-Mac Falls, (—DD), *Spies & Joffe 1973.*
E. cilianensis	10	TRANSVAAL.—2528 (Pretoria): Soutpan Experimental Farm, (—AC), *Spies 3287.*
E. sarmentosa	20	CAPE.—3118 (Vanrhynsdorp): Gifberg Pass, (—DC), *Spies 3105.*
Subtribe Sporobolinae		
Sporobolus africanus	12	CAPE.—3318 (Cape Town): near turnoff to Stellenbosch on road between Paarl and Franschhoek, (—DD), *Spies 3201.*
	18+0—6B	NATAL.—2832 (Mtubatuba): 12 km from Cape Vidal to St Lucia, (—AB), *Spies 2393.*
	24	CAPE.—3028 (Matatiele): near Antelope Park, (—CC), *Spies 2529.*
Tribe **Cynodonteae**		
Subtribe Chloridinae		
Harpochloa falx	20	CAPE.—3028 (Matatiele): 25 km from Rhodes to Maclear via Naude's Pass, (—CC), *Spies 2523.*
Subfamily **Panicoideae**		
Tribe **Paniceae**		
Subtribe Setariinae		
Panicum aequinerve	18	SWAZILAND.—2631 (Mbabane): 18 km north-east of Mbabane, (—AC), *Spies 2555.*
P. maximum	16	SWAZILAND.—2631 (Mbabane): 55 km from Siteki to Manzini, (—AD), *Spies 2603.*
Brachiaria brizantha	18	CAPE.—3028 (Matatiele): Antelope Park, (—CC), *Spies 2528.*
Urochloa mosambicensis	14	TRANSVAAL.—2528 (Pretoria): Soutpan Experimental Farm, (—AC), *Spies 3725.*
Subtribe Digitariinae		
Digitaria argyrograpta	9	TRANSVAAL.—2528 (Pretoria): Soutpan Experimental Farm, (—AC), *Spies 3739.*
D. diagonalis var. *diagonalis*	9	CAPE.—3228 (Butterworth): near Sunrise-on-Sea, (—CC), *Spies 1665.*
D. didactyla	9	SWAZILAND.—2631 (Mbabane): near Siteki, (—BD), *Spies 2596.*
D. eriantha	9	TRANSVAAL.—2528 (Pretoria): cultivated varieties collected at Roodeplaat Experimental Farm, (—CA), *Spies 3746, 3749, 3751, 3752, 3754, 3755, 3756 & 3760.*
	9+1—3B	TRANSVAAL.—2528 (Pretoria): cultivated variety collected at Roodeplaat Experimental Farm, (—CA), *Spies 3758.*
	9+2B	TRANSVAAL.—2528 (Pretoria): cultivated variety collected at Roodeplaat Experimental Farm, (—CA), *Spies 3759.*
	9+0—4B	CAPE.—3225 (Port Elizabeth): 7 km from Somerset East to Pearston, (—CB), *Spies 1130.*
	9+0—5B	TRANSVAAL.—2528 (Pretoria): cultivated variety collected at Roodeplaat Experimental Farm, (—CA), *Spies 3747.*
	9/18	TRANSVAAL.—2528 (Pretoria): cultivated varieties collected at Roodeplaat Experimental Farm, (—CA), *Spies 3757, 3761.*
	18	TRANSVAAL.—2528 (Pretoria): cultivated variety collected at Roodeplaat Experimental Farm, (—CA), *Spies 3748.*
D. maitlandii	9	SWAZILAND.—2631 (Mbabane): 22 km north-east of Mbabane, (—AA), *Spies 2568.*
	36	SWAZILAND.—2631 (Mbabane): near beacon at Maimba, (—AD), *Spies 2640.*
D. natalensis	9	NATAL.—2832 (Mtubatuba): 12 km from Cape Vidal to St Lucia, (—AB), *Spies 2399.*
D. tricholaenoides	9	TRANSVAAL.—2630 (Carolina): 46 km from Ermelo to Piet Retief, (—CD), *Spies 2349.*
Tribe **Andropogoneae**		
Subtribe Sorghinae		
*Sorghum australiense**	10	TRANSVAAL.—2528 (Pretoria): cultivated in the garden of the National Botanical Institute, Pretoria, (—CA), *Spies 1711.*
*S. matarankense**	5	TRANSVAAL.—2528 (Pretoria): cultivated in the garden of the National Botanical Institute, Pretoria, (—CA), *Spies 1713.*
*S. stipoideum**	5	TRANSVAAL.—2528 (Pretoria): cultivated in the garden of the National Botanical Institute, Pretoria, (—CA), *Spies 2736, 1738 & 1741.*
	5+2B	TRANSVAAL.—2528 (Pretoria): cultivated in the garden of the National Botanical Institute, Pretoria, (—CA), *Spies 1740.*
S. aff. *stipoideum**	5	TRANSVAAL.—2528 (Pretoria): cultivated in the garden of the National Botanical Instutute, Pretoria, (—CA), *Spies 1719.*
Subtribe Ischaeminae		
Ischaemum afrum	10	NATAL.—2832 (Mtubatuba): 3 km from Hluhluwe to False Bay, (—AB), *Spies 2431.*
Subtribe Andropogoninae		
Andropogon eucomus	10	TRANSVAAL.—2430 (Pilgrim's Rest): 17 km from Graskop to Sabie, (—DD), *Spies 1968.*

* Seed originally collected by M. Andrew in Australia.

Subfamily **Arundinoideae** Tateoka

Tribe **Aristideae** C.E. Hubb.

The haploid chromosome number of n = 11 for *Aristida congesta* Roem. & Schult. subsp. *congesta* (Figure 1A, B) corresponds with published cytogenetic information on this taxon (De Winter 1965; Davidse *et al.* 1986; Spies & Jonker 1987). The occurrence of n = 11 as the lowest haploid chromosome number in the genus and the presence of multiples of 11 in other species of this genus (De Winter 1965; Spies & Du Plessis 1986a, 1987b; Viano & Bourreil 1987), support 11 as the basic chromosome number for both the genus *Aristida* L. and the tribe.

The basic number of x = 11 for the tribe Aristideae is further supported by our observation of a *Stipagrostis obtusa* (Del.) Nees specimen with a haploid chromosome number of n = 22+0−3B (Figure 1C). Chromosome laggards were frequently observed (Figure 1D) and it is suggested that the laggards represent the B-chromosomes, undergoing chromatid segregation. This is, to the best of our knowledge, the first report on the presence of B-chromosomes in this tribe. Polyploidy seems to be present in this species with our specimen being tetraploid and the one examined by Reese (1957) diploid (2n = 22).

Subfamily **Chloridoideae** Rouy

Tribe **Eragrostideae** Stapf
Subtribe Eleusininae Dumort.

The diploid chromosome number of n = 10 for *Diplachne fusca* (L.) Beauv. ex Roem. & Schult. (Figure 1E) is the lowest chromosome number yet described for this species and it supports a basic chromosome number of x = 10 for this species, genus, subtribe, tribe and subfamily. Published results indicate the presence of tetraploidy (Bir & Sahni 1986) and aneuploidy (Spies & Voges 1988).

A basic chromosome number of x = 10 for *Eragrostis* Wolf is substantiated by the diploid *E. cilianensis* (All.) F.T. Hubb. specimen observed during this study. The presence of diploid and tetraploid specimens of this species is well documented (Fedorov 1969; Moore 1973; Goldblatt

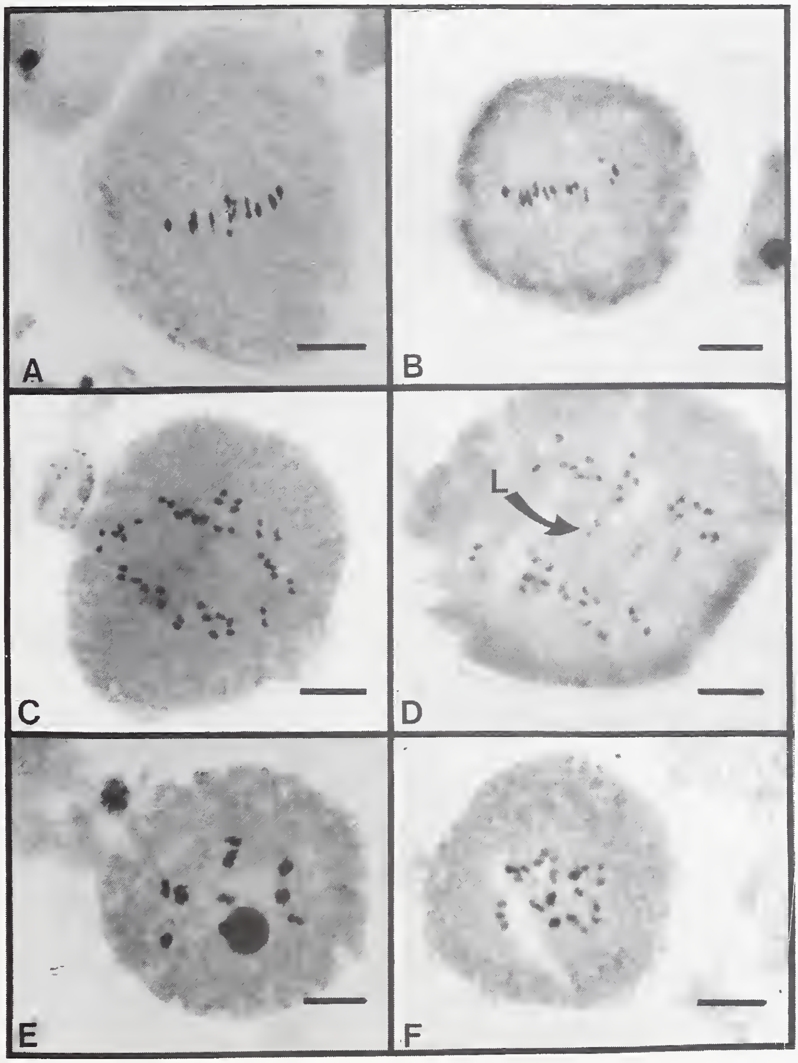

FIGURE 1.—Meiotic chromosomes in some grass specimens. A, B, *Aristida congesta* subsp. *congesta*, *Du Plessis 137*, n=11, metaphase I; C, D, *Stipagrostis obtusa*, *Spies 2905*, n=22, anaphase I with laggards (L); E, *Diplachne fusca*, *Spies 3373*, n=10, diakinesis; F, *Eragrostis capensis*, *Spies 1973*, n=20, diakinesis. Bar = 10 μm.

1983, 1988; Goldblatt & Johnson 1990). The tetraploid *E. capensis* (Thunb.) Trin. specimen (Figure 1F) supports observations indicating different ploidy levels for this species, i.e. diploid (De Wet 1958), tetraploid (Avdulov 1931; Pienaar 1955; Spies & Du Plessis 1986a; Davidse *et al.* 1986) and hexaploid (Moffett & Hurcombe 1949; Spies & Voges 1988). To the best of our knowledge the tetraploid level observed for *E. sarmentosa* (Thunb.) Trin. is the first report on a chromosome number for this species.

Subtribe Sporobolinae Benth.

The genus *Sporobolus* R. Br. is cytogenetically complex and basic chromosome numbers of x = 6, 9 and 10 seem to be present (Davidse *et al.* 1986). The haploid chromosome numbers of n = 12, 18 and 24 observed during this study in *S. africanus* (Poir.) Robyns & Tournay (Figure 2) support a basic chromosome number of x = 6 for this species. Polyploid levels vary from tetraploid (2n = 4x = 24) to decaploid (2n = 10x = 60) (Fedorov 1969; Spies & Du Plessis 1986b; Spies & Jonker 1987; Spies & Voges 1988). A thorough cytogenetic investigation of this genus is necessary to determine the phylogenetic relationships.

The presence of B-chromosomes in some specimens impedes the interpretation of the results (Figure 2C). The number of B-chromosomes varied from 0 to 6 per meiotic cell in a single specimen, which indicates that they are mitotically unstable. Occasionally a B-chromosome could be distinguished by its position in the cell but the majority of B-chromosomes resembled the euchromosomes. These chromosomes are considered to be B-chromosomes, judging by the variation in their numbers in different cells.

Tribe **Cynodonteae** Dumort.
Subtribe Chloridinae Presl.

This report on *Harpochloa falx* (L.f.) Kuntze corresponds with published data on this species (Fedorov 1969; Spies & Du Plessis 1986a) which seems to indicate a basic chromosome number of ten, with all the specimens studied being tetraploids.

Subfamily **Panicoideae** A. Br.

Tribe **Paniceae** R. Br.
Subtribe Setariinae Dumort.

The chromosome number of n = 18 observed for *Brachiaria brizantha* (A. Rich.) Stapf during this study, equals the lowest chromosome number reported for this species (Darlington & Wylie 1955; Ornduff 1967–1969; Fedorov 1969; Moore 1970–1977; Goldblatt 1981–1988; Goldblatt & Johnson 1990). In addition to this number, a higher ploidy level of n = 27 has also been described in Fedorov (1969) and by Spies & Du Plessis (1987b), as well as by Basappa *et al.* (1987). The basic chromosome number, however, is considered to be x = 9 (Darlington & Wylie 1955; Ornduff 1967–1969; Fedorov 1969; Moore 1970–1977; Goldblatt 1981–1985; Goldblatt & Johnson 1990). These results contradict the meiotic configuration of $12_{II}12_{I}$, observed by Nath *et al.* (1970), which suggests a basic chromosome number of 12 for the species.

This seems to be the first report on the chromosome number of *Panicum aequinerve* Nees. The haploid chromosome number of 18 indicates a basic chromosome number of x=9 for this genus and species. The absence of multivalents suggests an alloploid origin for this specimen (Figure 3A). In contrast to this basic number, we confirm numerous reports of a somatic chromosome number of 2n=32 for *Panicum maximum* Jacq. (Ornduff 1967–1969; Fedorov 1969; Moore 1970–1977; Goldblatt 1981–1988; Goldblatt & Johnson 1990). Contrary to these reports several other somatic numbers are reported in the same sources (2n=18, 28, 34, 36, 42, 48, 52, 54). We found it very difficult to obtain well-spread meiocytes in this species and this may be a reason for the discrepancies in the chromosome numbers reported for this species. A re-investigation of the phylogenetic relationship between *P. maximum* and other *Panicum* species is necessary.

Urochloa mosambicensis (Hack.) Dandy with 2n = 4x = 28, supports the deviated basic chromosome number of x = 7 for this species reported by Spies & Du Plessis (1987b). The formation of one ring quadrivalent in almost all diakinesis cells studied (Figure 3B), indicates

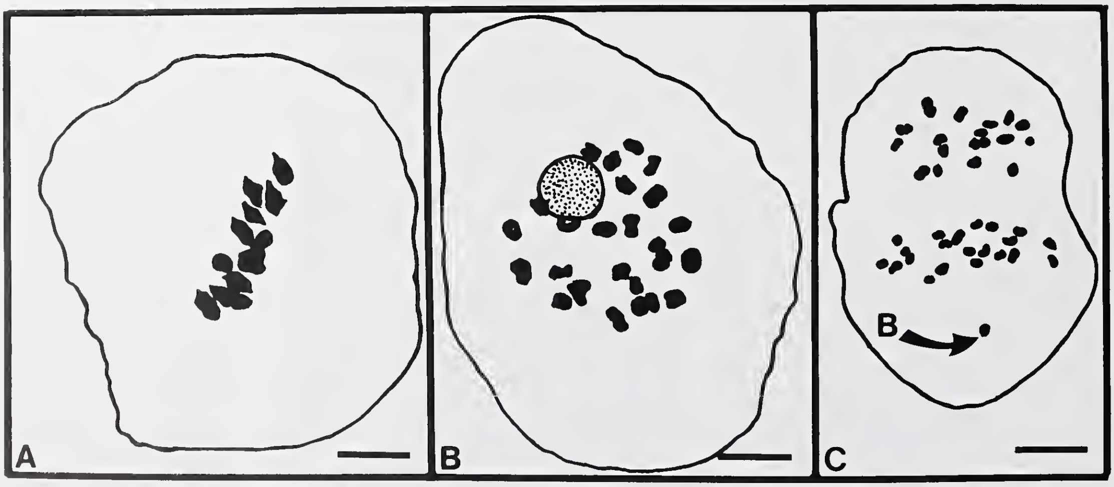

FIGURE 2.—Camera lucida drawings of meiotic chromosomes in *Sporobolus africanus*. A, *Spies 3201*, n = 12, metaphase I; B, *Spies 2529*, n = 24, diakinesis; C, *Spies 2393*, n = 18 + 0–6B, anaphase I with 6 B-chromosomes. Bar = 10 μm.

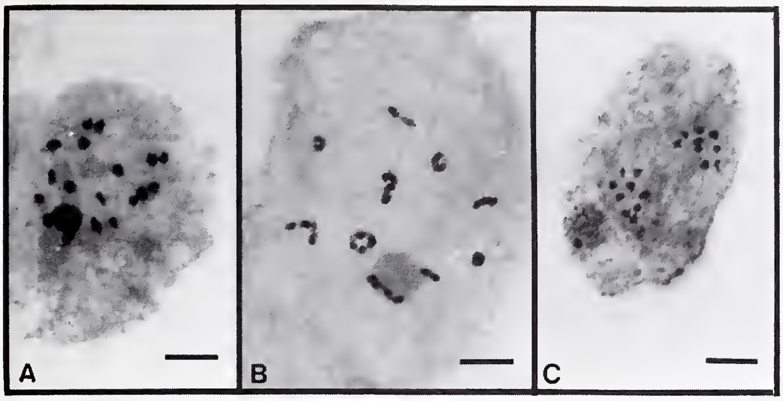

FIGURE 3.—Meiotic chromosomes in some representatives of the subfamily Panicoideae. A, *Panicum aequinerve, Spies 2555*, n = 18, diakinesis; B, *Urochloa mosambicensis, Spies 3725*, n = 14, diakinesis with 1_{IV} 12_{II}; C, *Digitaria argyrograpta, Spies 3739*, n = 9, anaphase I. Bar = 10 μm.

a certain degree of autosyndetic chromosome pairing. The low frequency of multivalents in the presence of a high chiasma frequency (Spies 1984) indicates a segmental alloploid origin for this specimen.

Subtribe Digitariinae Butzin

This is the first report on the chromosome numbers of *Digitaria argyrograpta* (Nees) Stapf (n=9) and *D. maitlandii* Stapf & C.E. Hubb. (n=9 & 36). In addition a new level of ploidy is described for *D. diagonalis* (Nees) Stapf var. *diagonalis* [n=9, in contrast to the 2n=36 described by De Wet & Anderson (1956) and Spies & Du Plessis (1987a)]. This is also the first report on the presence of B-chromosomes in *D. eriantha* Steud., where four of the 15 specimens studied had up to five B-chromosomes (Table 1).

This study included several cultivated specimens of *D. eriantha*. These cultivars are currently being evaluated for possible distribution as fodder crops by the Grassland Research Centre. Two of these 'cultivars' had two different ploidy levels. This indicates the variability present in these specimens and the need for a thorough cytogenetic investigation before these cultivars are released.

A basic chromosome number of x=9 for the genus is supported by the presence of diploid specimens in all the species studied (Figure 3C).

Tribe **Andropogoneae** Dumort.
Subtribe Sorghinae Bluff

A basic chromosome number of five in the Andropogoneae is evident from both the literature and some of the *Sorghum* Moench specimens used during this study. A basic chromosome number of x=5 was observed in both *S. matarankense* Garber & Snyder and *S. stipoideum* Gardner & Hubb. These numbers correspond to the published numbers by Garber (1950, 1954), Garber & Snyder (1951) and Celarier (1956a, 1958). Although meiosis was normal in most specimens (Figure 5A–C), some cells formed micronuclei (Figure 5D).

Abnormal meiotic behaviour was observed in one of the *S. stipoideum* specimens, *Spies 1740*. Six bivalents were formed during diakinesis (Figure 4A). One of these bivalents was smaller than the rest and it is concluded that this bivalent is formed by B-chromosomes. The B-chromosomes seem to be outside the spindle. Different behaviour patterns of the B-chromosomes were observed during metaphase I. They form part of the metaphase plate (Figure 4B); one stays on the metaphase plate while the other moves to one of the poles (Figure 4C); both move towards the same pole (Figure 4D) or they move to different poles (Figure 4F). Precocious chromosome segregation during late metaphase I was observed for one bivalent in one cell (Figure 4E). The result of the different movements of the B-chromosomes is that anaphase II laggards are sometimes observed (Figure 4G). The ultimate fate of the B-chromosomes was not determined by this study.

Subtribe Ischaeminae Presl

Cytogenetic studies on *Ischaemum afrum* (J.F. Gmel.) Dandy seem to be restricted to our laboratories (Spies & Du Plessis 1987b). The formation of bivalents only during meiosis and the absence of specimens with a somatic chromosome number of ten indicate that this specimen can be considered to be a diploid (2n=2x=20). These results are substantiated by reported chromosome numbers for other *Ischaemum* species (Darlington & Wylie 1955; Ornduff 1967–1969; Fedorov 1969; Moore 1970–1977; Goldblatt 1981–1985; Goldblatt & Johnson 1990). However, the same reports suggest that x=9 and x=19 should be considered secondary and tertiary basic chromosome numbers respectively in the genus.

Subtribe Andropogoninae Presl

The chromosome number of n=10 observed for *Andropogon eucomus* Nees, corresponds with the number published by Moffett & Hurcombe (1949) and Gould (1956). Previous studies by one of our laboratories revealed two different chromosome numbers for this species, i.e. n=10 and n=20 (Spies & Du Plessis 1987a, b). These numbers, in addition to the presence of multiples of ten in other *Andropogon* species, as well as the absence of 2n=2x=10 specimens in the genus (Darlington & Wylie 1955; Ornduff 1967–1969; Fedorov 1969; Moore 1970–1977; Goldblatt 1981–1985), suggest a basic chromosome number of x=10 for this species and genus. A deviation from this basic chromosome number was reported with x=9 for *A. lacunosus* J.G. Anders., *A. tectorum* Schum. & Thonn., *A. lima* (Hack.) Stapf and *A. distachyos* L.

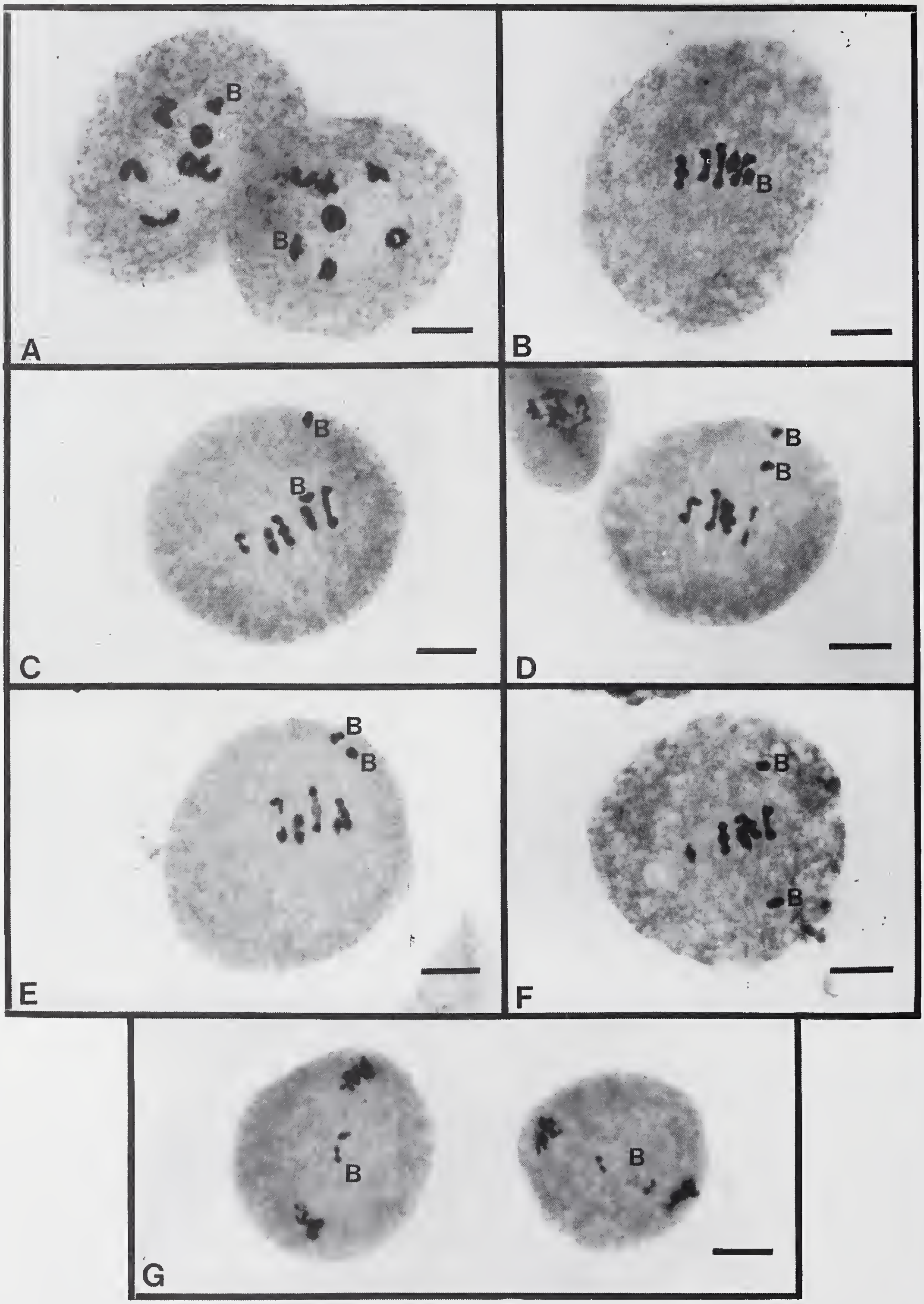

FIGURE 4.—Meiotic chromosomes in a *Sorghum stipoideum* specimen with B-chromosomes, *Spies 1740.* A, diakinesis with five bivalents and a B-chromosome bivalent; B, metaphase I with five bivalents and both B-chromosomes on the equatorial plate; C−E, metaphase I with five bivalents and both B-chromosomes on one side of the equatorial plate; F, metaphase I with five bivalents and the B-chromosomes on different sides of the equatorial plate; G, two telophase I cells with chromatid segregation of the B-chromosomes. Bar = 10 μm.

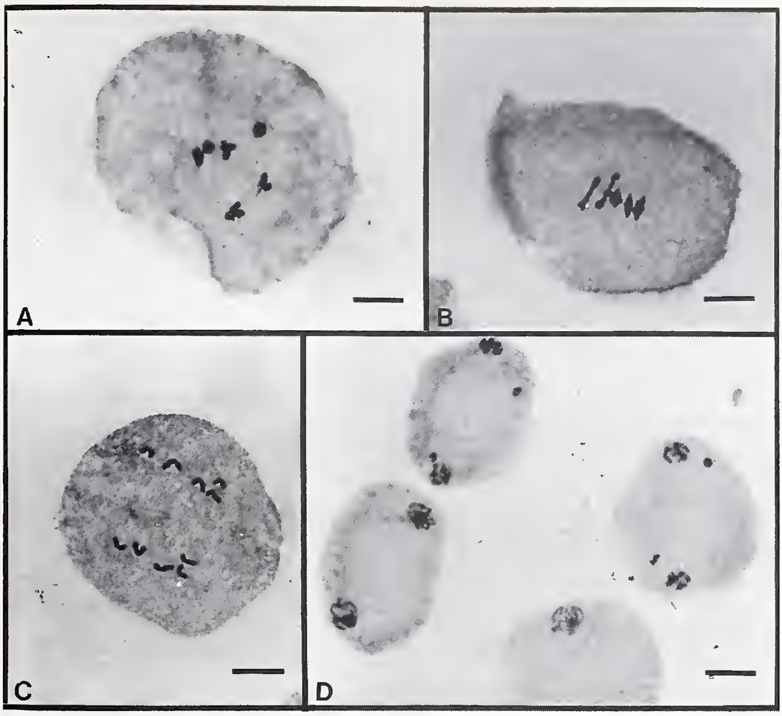

FIGURE 5.—Meiotic chromosomes in *Sorghum stipoideum*. A, *Spies 1741*, n = 5, diakinesis; B, *Spies 1741*, n = 5, meta- phase 1; C, *Spies 1738*, n = 5, anaphase 1; D, *Spies 1738*, n = 5, telophase I with micronuclei visible. Bar = 10 μm.

(Celarier 1956b; Gould 1956; Hedberg & Hedberg 1977; Okoli 1982; Spies & Du Plessis 1986a), x = 8 for *A. abyssinicus* Chippind. (Gould 1956) and x = 7 for *A. mannii* Hook. f. (Davidse *et al.* 1986).

CONCLUSIONS

Clayton & Renvoize (1986) claim that chromosome numbers can contribute little to the taxonomy of the grasses, since the karyotype is relatively constant. Yet the relevance of cytogenetics to the taxonomy of grasses is apparent in the different basic chromosome numbers present in higher taxa, in the meiotic behaviour of chromosomes and in the mode of polyploidy which may help to unravel the phylogeny of a taxon.

A correlation exists between the basic chromosome number and the tribal classification of the majority of grasses. This study confirms that the following basic chromosome numbers are found in the following tribes: Aristideae x = 11, Eragrostideae (with the exception of the genus *Eleusine* and some *Sporobolus* representatives) x = 10, Cynodonteae x = 10, Paniceae x = 9 (with some species or genera having x = 7, 8 or 10) and Andropogoneae has a primary basic chromosome number of x = 5 and, more commonly, a secondary basic chromosome number of x = 10. Although deviations from these basic numbers are known, the phylogenetic development of higher taxa is correlated with a specific basic chromosome number and deviations from these numbers may help to solve relationships in some taxa.

Polyploidy is frequently observed in the grasses (Carnahan & Hill 1961; Goldblatt 1980) and 303 of the 388 specimens studied in our laboratories were polyploids (Spies & Du Plessis 1986a, b, 1987a, b, 1988; Spies & Jonker 1987; Spies & Voges 1988; Du Plessis & Spies 1988; Spies *et al.* 1989). Detailed cytogenetic studies are necessary to determine the mode of polyploidy as well as the extent of polyploidy in the South African grasses.

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The chromosomes of *Chortolirion* and *Poellnitzia* (Asphodelaceae: Alooideae)

G.F. SMITH*

Keywords: Asphodelaceae, Alooideae, *Chortolirion angolense*, chromosome number, karyotype, *Poellnitzia rubriflora*

ABSTRACT

The somatic chromosomes of *Chortolirion angolense* (Baker) A. Berger and *Poellnitzia rubriflora* (L. Bol.) Uitewaal have been studied. Both taxa are monotypic genera in the subfamily Alooideae of the Asphodelaceae. Prior to this study *Chortolirion* had not been cytologically examined, while karyograms and idiograms have never been presented for *Poellnitzia*. *Chortolirion* and *Poellnitzia* are diploid with 2n = 14 chromosomes and with a bimodal karyotype typical of the entire subfamily, comprising four pairs of long chromosomes and three pairs of short chromosomes. For *Poellnitzia* minute structural differences in karyotype morphology were noted between observed and published data, especially with regard to the presence of satellites.

UITTREKSEL

Die somatiese chromosome van *Chortolirion angolense* (Baker) A. Berger en *Poellnitzia rubriflora* (L. Bol.) Uitewaal is bestudeer. Beide taksons is monotipiese genusse in die subfamilie Alooideae van die Asphodelaceae. *Chortolirion* is nog nooit voorheen sitologies ondersoek nie, terwyl kariogramme en idiogramme van *Poellnitzia* nog nie voorheen aangebied is nie. *Chortolirion* en *Poellnitzia* is beide diploïed met 2n = 14 chromosome en elk beskik oor 'n bimodale kariotipe wat uit vier pare lang en drie pare kort chromosome bestaan. Hierdie kariotipe is soortgelyk aan dié van die oorgrote meerderheid taksons in die Alooideae. Veral ten opsigte van die teenwoordigheid van satelliete bestaan daar by *Poellnitzia* fyn, strukturele verskille in kariotipe-morfologie tussen waargenome en gepubliseerde data.

INTRODUCTION

The subfamily Alooideae of the Asphodelaceae (*sensu* Dahlgren *et al.* 1985) includes about seven genera and more than 450 species. Most Alooideae taxa are found in subSaharan Africa, with a marked concentration of species and genera in southern Africa. All species of Alooideae are petaloid, succulent-leaved, rosulate or distichous perennials. They differ in size from miniatures barely 10 mm high (*Haworthia parksiana* Von Poellnitz) to trees of massive bulk up to 20 m tall (*Aloe bainesii* Thiselton-Dyer). In spite of this notable morphological variation the Alooideae is reasonably homogeneous in an evolutionary sense, unifying characters being the widespread occurrence of secondary thickening growth, leaf succulence, usually tubular petaline flowers and fusion of the perianth segments. Furthermore, in the entire subfamily the basic diploid karyotype (2n = 14; four pairs of long chromosomes and three pairs much shorter) is only very rarely altered (Brandham 1969).

The majority of species of Alooideae has been investigated cytologically. These studies were initiated early in the 20th century and have resulted in an extensive bibliography on the cytology of this group (for reviews see Muller 1941; Riley 1959a,b,c; Brandham 1971, 1983; Riley & Majumdar 1979). The intention of the present paper is to contribute to the cytotaxonomic knowledge of the Alooideae by the chromosome complement analysis of *Chortolirion* Berger and *Poellnitzia* Uitewaal, two monotypic genera. Chromosome studies have not been reported for *Chortolirion* to date and for *Poellnitzia* only four previous counts have been published, one of which is not readily accessible (Majumdar 1968 quoted by Riley & Majumdar 1979). The previous cytological observations of *Poellnitzia* were all made on specimens cultivated in botanic gardens (Resende 1937; Viveiros 1949; Majumdar & Riley 1972). These early cytological studies therefore had no connection with natural populations. Problems which arise from such a practice have been discussed by Riley & Majumdar (1979).

C. angolense (Baker) A. Berger is a perennial, deciduous herb with a subterranean bulb and is widely distributed in the summer rainfall region of southern Africa. With short, annual, succulent shoots arising from the bulb in early spring, *C. angolense* presents a combination of geophytic and succulent habits (Figure 1). *P. rubriflora* (L. Bol.) Uitewaal is a low-growing, caulescent, succulent herb. Stems are up to 250 mm long and densely leaved. The ovate leaves are pungent-acuminate and up to 40 mm long (Figure 2). *P. rubriflora* has a restricted distribution in the south-western Cape Province of South Africa. This region receives its precipitation mainly during the winter months.

Chortolirion and *Poellnitzia* have been the subject of taxonomic confusion (Bayer 1974; cf. Smith 1988). A revision of the smaller genera of Alooideae currently under way has shown that both taxa warrant recognition as monotypic genera.

MATERIAL AND METHODS

The origin of the material of *C. angolense* studied is:

TRANSVAAL.—2528 (Pretoria): in habitat in the Botanic Garden of the National Botanical Institute, Pretoria, (–CB), *Smith 8* (PRU).

Material of *P. rubriflora* was collected at:

CAPE.—3320 (Montagu): southern side of farm 'Langverwagt 169', 5 km W of Bonnievale, (–CC), *Stayner s.n. sub Smith 9* (PRU).

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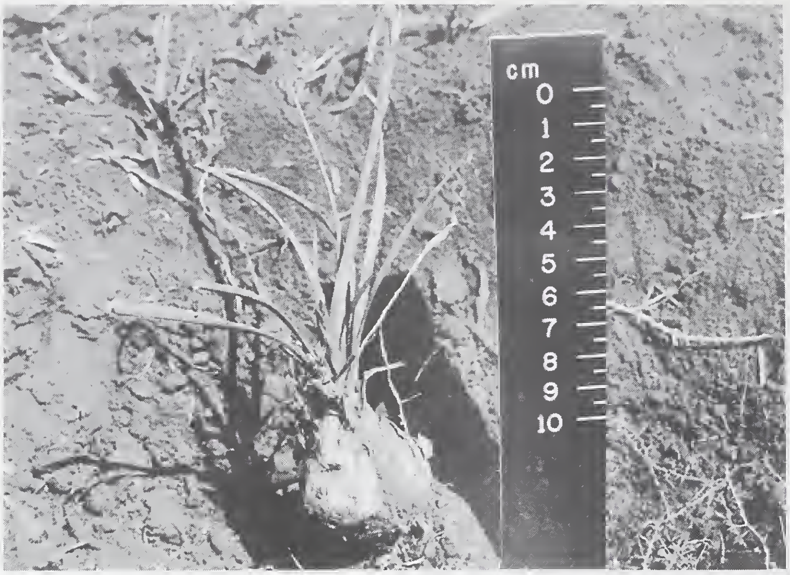

FIGURE 1.—Growth form of *Chortolirion angolense* in habitat in grassland at Potchefstroom, south-western Transvaal, South Africa. The soil has been removed to show the bulb and narrowly linear leaves.

Plants for cytological study were grown in the greenhouse of the Department of Botany, University of Pretoria. Somatic chromosomes were studied in root tips collected during late winter/early spring from vigorously growing potted plants. Actively elongating root tips (2—5 mm) were collected at 14:00 and pretreated with freshly prepared colchicine (0,05% in distilled water) for 2h and fixed in Pienaar's (1955) fixative (methanol: chloroform: propionic acid in the ratio 6:3:2) for 16h. Root tips were hydrolysed for 12 minutes in a 1M hydrochloric acid solution kept at 60°C and stained in Feulgen for 2,5 h. Squash preparations were made using a standard technique (Van der Schijff & Robberste 1976). Photographs were taken with a Nikon FX 35A microscope fitted with a Nikon Optiphot camera. Measurements were made directly from mitotic preparations using an eyepiece micrometer. For chromosome nomenclature, the terminology introduced by Levan *et al.* (1964) has been followed. The karyograms (Figures 3B; 4B) and idiograms (Figures 3C; 4C) are arranged according to chromosome length.

RESULTS

In *Chortolirion* and *Poellnitzia* the somatic chromosome number 2n = 14 was constant in all metaphases with karyotypes as in Figure 3B (*Chortolirion*) and Figure 4B (*Poellnitzia*). For both genera the haploid set is asymmetrical, producing a distinctly bimodal karyotype which consists of four long and three short chromosomes. No major chromosomal differences between *Chortolirion* and *Poellnitzia* could be detected. Furthermore, no marked size variation was encountered within the sets of long and short chromosomes in the respective genera.

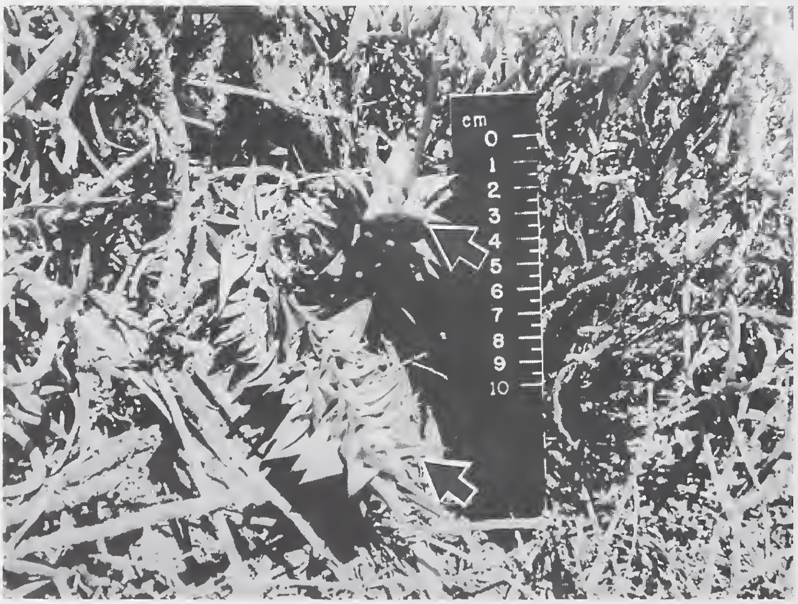

FIGURE 2.—*Poellnitzia rubriflora* (arrowed) in habitat at Langverwacht near Bonnievale, south-western Cape Province, South Africa. The species usually grows in association with sclerophyllous xerophytes.

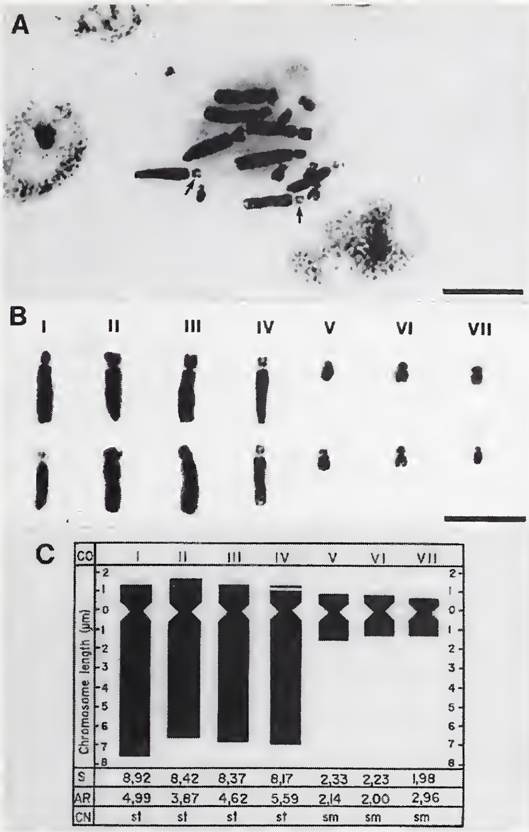

FIGURE 3.—*Chortolirion angolense*. A, mitotic metaphase, arrows indicate satellites; B, karyogram; C, idiogram. CO, chromosome ordering (overall length); S, chromosome size; AR, arm ratio (= long arm/short arm); CN, chromosome nomenclature after Levan *et al.* (1964). Chromosome II is clearly the L1 (long chromosome with longest short arm) and chromosome I is the L2, which is often longer than the L1.

Karyotype of *C. angolense*

Each of the long chromosomes (I–IV) is of the st type, while all the short chromosomes (V–VII) are of the sm type (Figure 3C). Satellites were detected at the ends of the short arms of the shortest long chromosome (IV) (Figure 3A, B). Secondary chromosome constrictions are absent from the long arms of the short chromosomes (V–VII). Such constrictions occur widespread in taxa of the Alooideae (Brandham 1971).

One chromosome I has a short arm much smaller than that of the other (Figure 3A, B). Since this phenomenon was not encountered consistently, it is probably not associated with an interchange or a deletion, but rather due to the orientation of the chromosome on the slide.

Karyotype of *P. rubriflora*

The longest long chromosome (I) is of the sm type while the three other long chromosomes (II–IV) are of the st type. The longest short chromosome (V) is of the m type and the two remaining short chromosomes (VI–VII) are of the sm type (Figure 4C). Satellites were not detected on any of the chromosomes (Figure 4A, B). Secondary constrictions of unknown nature were observed on the short arms of the long chromosomes (except I) and the long arms of all the short chromosomes.

DISCUSSION

The chromosomes of all plants studied were found to match the markedly bimodal karyotype which has been observed in every species of Alooideae to date. The basic number is × = 7 and comprises four long and three short chromosomes. To date a large number of intra- and intergeneric hybrids produced in the Alooideae have been described and figured (Riley 1948; Jacobsen & Rowley 1955, 1973; Rowley 1968, 1976; Graf 1980). Although some of the hybrids are sterile, others are fully fertile (Brandham 1973). This testifies to the close cytogenetical relationship which exists amongst taxa of the Alooideae (Rollins 1953). *Chortolirion* and *Poellnitzia* are no exceptions to this rule, *Chortolirion* having been crossed successfully with *Aloe* and *Poellnitzia* with *Gasteria* (Rowley 1980, 1982; Brandham 1990).

Both *Chortolirion* and *Poellnitzia* are diploid with 2n = 14 chromosomes, in common with the great majority of species in the subfamily Alooideae as a whole. Although *Aloe, Gasteria* and *Haworthia* are known to include a

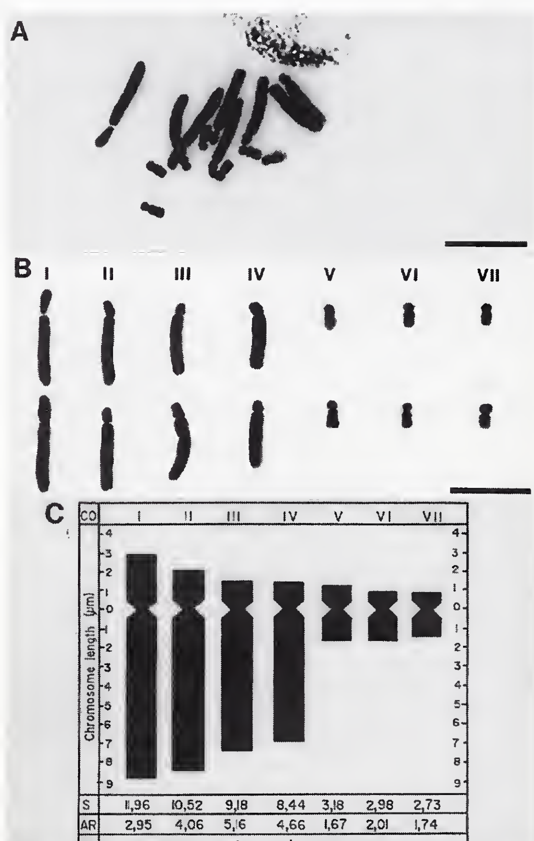

FIGURE 4.—*Poellnitzia rubriflora*. A, mitotic metaphase; B, karyogram; C, idiogram. CO, chromosome ordering (overall length); S, chromosome size; AR, arm ratio (= long arm/short arm); CN, chromosome nomenclature after Levan *et al.* (1964).

variety of polyploids (Riley & Majumdar 1965; Brandham & Johnson 1977a, 1982; Cutler *et al.* 1980; Brandham 1982; Motohashi *et al.* 1985), none of the individuals included in the present study contained different levels of ploidy. In the Alooideae polyploidy can give rise to local bursts of speciation (Brandham & Cutler 1981; Cutler *et al.* 1980).

Some authors have previously established a nomenclature for the chromosomes of taxa of the Alooideae (L1 through L4 for the long chromosomes and S1 through S3 for the short chromosomes) (Snoad 1951; Riley & Majumdar 1966; cf. Brandham 1971 for an explanation; Brandham & Johnson 1977b; Brandham & Cutler 1978, 1981). However, the identification of individual chromosomes (especially the short chromosomes) and their subsequent classification is very difficult and no attempt was made to do so here. Brandham (1983) eventually concluded that only L1 (long chromosome with longest short arm) could be identified with certainty in somatic and meiotic cells. However, recognition even of the L1 chromosome, which usually is the only submetacentric long chromosome, can occasionally yield difficulties as is shown in reports of Mogford & Rautenbach (1981), Vosa & Bayer (1981) and Vosa & Mogford (1981). In *Chortolirion* chromosome II is clearly the L1 and chromosome I is the L2, which is often longer than the L1 (Figure 3C). In *Poellnitzia* chromosome I is the L1 (Figure 4C).

In the case of *Poellnitzia* the short arms of the long chromosomes, with the exception of the longest long chromosome (I), and the long arms of the short chromosomes appeared to be thinner in their mid-region than at either end (Figure 4). These thin regions [secondary constrictions *sensu* Sharma & Mallick (1966)] have been used as the basis for the establishment of a number of different types of chromosomes (Sharma & Mallick 1966). As Brandham (1971) justifiably remarks, the constrictions could possibly be due to variations in the degree of coiling of the chromatids and are structurally insignificant. Thinner regions on the chromosomes were virtually absent from *Chortolirion*, with the exception of satellites present on the short arms of the two shortest long chromosomes (IV) (Figure 3).

The chromosome count of *Poellnitzia* agrees with that reported by Resende (1937), Viveiros (1949), Riley (1961) and Majumdar & Riley (1972), but the chromosome morphology differs in that the latter workers reported satellites as being present on the long arms of two long chromosomes [L1 and L4 *sensu* Majumdar & Riley (1972)]. In the present study no satellites were observed in *Poellnitzia* (Figure 4). The differences in karyotype morphology between published and observed data indicate the existence of chromosomal variability in *Poellnitzia*. It is noteworthy that considerable variation in the number and position of satellites has also been reported for other species of Alooideae genera (Brandham 1971; Spies & Hardy 1983). This karyotype character therefore appears to be taxonomically insignificant.

Knowledge of chromosome morphology in closely related taxa is of primary importance in biosystematic and taxonomic studies. In the Alooideae studies of karyotypes are particularly informative, where the asymmetry in size within complements can assist in determining the progress of chromosome alteration and its consequences. However, some doubt still exists with regard to the phylogenetical significance of certain karyological aspects, such as overall size of chromosomes. Majumdar & Riley (1972) have, for example, suggested that in the species of the various genera of Alooideae, reduction in chromosome size is paralleled by a reduction in size and specialization of the plant. In contrast, Brandham (1983) has shown that, at least in *Aloe*, there is a gradation from smaller chromosomes in primitive species to larger ones in advanced species. The latter are often highly adapted miniatures. Similarly, the chromosomes of *Gasteria* are larger than those of *Aloe* (Brandham 1990). *Gasteria* is generally regarded as phylogenetically more advanced than *Aloe* (Van Jaarsveld 1989). The karyotypes of species of *Gasteria* are also more acutely bimodal than those of species of the more primitive *Aloe*. Based on chromosome size and increased bimodality *Poellnitzia* would therefore appear to be more advanced than *Chortolirion*. However, the complexity of interpreting taxa of the Alooideae as either primitive or advanced, is illustrated by the suggestion of Hayashi (1987), based on callus characteristics, that *Poellnitzia* is a relict of early Alooideae. For *Chortolirion*, a close affinity was suggested with *Haworthia* subgenus *Haworthia*, a derived group. It is therefore clear that a multidisciplinary approach should be followed when drawing conclusions regarding the phylogenetic position of Alooideae taxa. In such studies wide-ranging karyological analyses will be of crucial importance (cf. Carter *et al.* 1984).

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Invasive alien woody plants of the northern Cape

L. HENDERSON*

Keywords: alien, invasive woody plants, Kalahari, Nama-Karoo Biome, northern Cape, *Prosopis* spp., roadside survey, Savanna Biome

ABSTRACT

The frequency and abundance of invasive alien woody plants were recorded along roadsides and at watercourse crossings in 31% (90/286) of the quarter degree squares in the study area. The survey yielded 23 species of which the most prominent invaders were *Prosopis* spp. The most prominent remaining species were: *Opuntia ficus-indica, Nicotiana glauca* and *Melia azedarach*.

The greatest abundance and diversity of alien invader plants were recorded near human settlements. More than half of the total recorded species have invaded perennial riverbanks. The episodic Molopo and Kuruman Rivers have been invaded almost exclusively by *Prosopis* spp., which in places have formed extensive stands.

UITTREKSEL

Die frekwensie en volopheid van uitheemse houtagtige indringerplante is langs paaie en by oorgange oor waterlope in 31% (90/286) van die kwartgraadvierkante in die studiegebied aangeteken. Daar is 23 spesies aangetref waarvan die prominentste indringers *Prosopis* spp. was. Die prominentste oorblywende spesies was *Opuntia ficus-indica, Nicotiana glauca* en *Melia azedarach*.

Uitheemse indringerplante was die volopste en het in die grootste verskeidenheid voorgekom naby plekke waar mense woon. Meer as die helfte van die spesies wat aangeteken is, het die oewers van standhoudende riviere ingeneem. Die tydelike Molopo- en Kurumanriviere is feitlik uitsluitlik ingeneem deur *Prosopis* spp. wat op sommige plekke uitgestrekte stande gevorm het.

CONTENTS

INTRODUCTION

Survey history and objectives

This study of the northern Cape is the fourth of eight regional surveys which together are designed to reflect invasion by woody alien plants in the Republic of South Africa as a whole. Surveys have been completed for the Transvaal (Henderson & Musil 1984), Natal (Henderson 1989) and Orange Free State (Henderson 1991). This survey of the northern Cape was undertaken in April 1989.

The objectives of the survey are: to produce a checklist of the major invasive alien woody plants of streambank, roadside and veld habitats in the study area; to determine the pattern of alien woody invasion as a whole and for individual species; to attempt to relate distribution to environmental factors and to determine which are the most prominent and potentially important invaders.

The study area

The study area is the Cape Province north of the Orange River. It is bounded by Botswana in the north, Namibia in the west, and the Transvaal and Orange Free State in the east. It lies between latitudes 25° and 30°S and longitudes 20° and 26°E (Figure 1).

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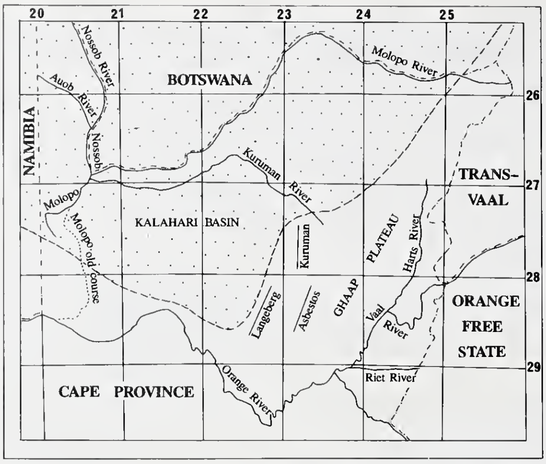


FIGURE 1.—The study area, showing the major physical features and its relation to surrounding territories.

The study area incorporates the southern end of the Kalahari basin which is a virtually continuous surface of red or whitish sand stretching from the Orange River in the south to equatorial Africa in the north (Wellington 1955). Longitudinal dune ridges are most strongly developed in the south-western parts of the study area. Towards the east the sand forms a flat to undulating surface. The altitude of this sandy area ranges from 600 to 1 200 m above sea level (King 1951). The southern periphery of the basin is bordered by a plateau of higher-lying rocky terrain. The most prominent features are the Langeberg, Kuruman and Asbestos Mountains and the Ghaap Plateau (Figure 1). The latter lies about 1 500 m above sea level and is an outlier of the extensive Highveld plateau of South Africa, detached from it by the Harts, Vaal and Orange Rivers.

The major rivers draining the plateau of the study area are the Orange, Vaal, Harts and Riet Rivers, all of which are usually perennial and flow from east to west. The Kalahari basin is drained by the Molopo and Kuruman Rivers from the east, and the Auob and Nossob Rivers from the north-west. All four rivers converge in the centre of the basin, the Molopo receiving the other three as tributaries. These rivers are usually dry, flowing only for short periods during abnormally wet seasons. The rare floodwaters that reach the lower course of the Molopo River are diverted by a sand dune across the old river course into a large pan (Leistner 1967).

The climate ranges from arid in the west to semi-arid in the east (Schulze & McGee 1978). Rain falls mainly in summer and is extremely variable (Tyson 1986). The mean annual rainfall ranges from less than 200 mm in the west to about 500 mm in the east (King 1951). Summers are very hot with temperatures frequently exceeding 30°C (Tyson 1986) and maximum temperatures generally in the vicinity of 40°C and occasionally higher (Bands & Britton 1977; Leistner 1967). Winter temperatures can drop below 0°C (at least 30 days per annum in the east) (Tyson 1986) and frost varies from light in the west to moderate in the central and eastern parts (Poynton 1972).

There are two biomes, Savanna and Nama-Karoo, in the study area (Rutherford & Westfall 1986) (Figure 2). The Savanna Biome, characterized by the codominance of hemicryptophytes (mainly grasses) and phanerophytes (trees and shrubs) is situated in the central and eastern semi-arid parts. The Nama-Karoo Biome, characterized by the codominance of hemicryptophytes (mainly grasses) and chamaephytes (dwarf shrubs), is situated in the western arid parts. Both these Biomes incorporate parts of the Kalahari basin and the stony plateau.

Seven Acocks Veld Types (Acocks 1988) occur in the study area (Table 1) of which Kalahari Thornveld (No. 16) is the most extensive and occupies the greater part of the region. This is a very broad veld type and occurs in one of Acocks's most under-sampled areas (Rutherford & Westfall 1986). More intensive studies by Gubb (in prep.) have revealed 21 major vegetation units in the northern Cape Savanna alone.

Rutherford & Westfall's (1986) delineation of the Savanna and Nama-Karoo Biomes cuts across Acocks's Veld Type categories in this region (Table 1). The main reason for this is the occurrence of different life form combinations in the same veld types (Rutherford & Westfall 1986).

The greater part of the study area is sparsely populated and is used for stock farming. The eastern regions of the Savanna Biome are primarily cattle farming areas, whereas the western regions of the Savanna Biome and the Nama-Karoo Biome are sheep farming areas (Gubb 1985). Intensive agricultural land use is mainly restricted to the land bordering the perennial rivers.

METHOD

Sampling method

The method used in this survey was basically the same as that used in previous surveys but with changes to the abundance scale for streambank habitats recommended by Henderson (1989) (see next subheading). The presence and abundance of all naturalized alien trees and large shrubs were recorded for each veld type category, habitat type (roadsides and adjoining veld, and streambanks) and

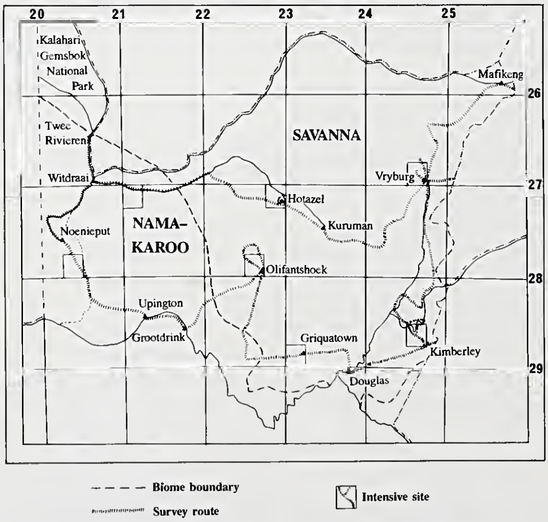


FIGURE 2.—The study area, showing its biomes [after Rutherford & Westfall (1986)], survey route and intensive sites.

TABLE 1.—Biomes [according to Rutherford & Westfall (1986)], Acocks Veld Type groupings and Veld Type numbers (Acocks 1988) sampled in the study area

Biome	Acocks Veld Type grouping	Acocks Veld Type No.
Savanna	Tropical bush and savanna types	16, 17, 19
	Karoo and False Karoo types	32, 40
Nama-Karoo	Tropical bush and savanna types	16, 17
	Karoo and False Karoo types	27, 32, 36

quarter degree/fifteen minute square traversed by road. Seven quarter degree squares were selected for more intensive surveying (Figure 2). They may be used at a later date for a quick resurvey of the study area to assess any changes that may have taken place.

Recordings of roadside and veld invaders were made from a moving vehicle along road transects of between five and ten kilometres in length. The average transect length was 8,9 km for the general survey and 5,0 for intensive sites. Abundance estimates were based on the frequency of encounter of invader species within each transect. Recordings of streambank invaders were made at watercourse crossings or at regular five kilometre intervals along watercourses with few or no crossings. The latter situation applied to the dry riverbeds of the Kuruman, Nossob and Molopo Rivers where roads travelled were either adjacent to the watercourses or in the riverbeds.

An unusual situation arose during this survey in that most of the roads used to survey the Nama-Karoo Biome followed watercourses very closely. Roadside recordings were continued as normal along these routes even though at times the road travelled was in the riverbed. This must be taken into account when interpreting the results for invaders of roadside and veld habitats in the Nama-Karoo Biome.

Abundance ratings

The abundance ratings for invaders of roadside and veld habitats and streambank habitats are given in Table 2. Henderson (1989) recommended that the abundance scale for streambank habitats be revised or replaced with a cover-abundance scale. In this survey the Braun-Blanquet cover-abundance scale has been used. Like the scale used in previous surveys, it has seven numbered ratings. The ratings in the old and new scales are roughly comparable. The new scale differs from the Braun-Blanquet scale, which is numbered from one to five with two ratings, r and +, below one. The upper four scale values refer only to cover, which is understood as the vertical crown or shoot-area projection per species. The lower scale values are primarily estimates of abundance, that is number of individuals per species (Mueller-Dombois & Ellenberg 1974). Whereas the Braun-Blanquet scale is intended to be applied to a reference area of uniform size, this has not been the case in this survey. Instead the reference area has been defined by the width of the watercourse and the distance (up to 100 m on either side of the crossing) to which invaders can be observed.

Sampling level achieved

The sampling level achieved was 31% (90 out of the total 286 quarter degree squares) at an average of 22,8 km travelled per square. An average of 17,7 km of road transects were sampled per quarter degree square for abundance estimates of roadside and veld invaders.

The coverage of each biome, Acocks Veld Type grouping and the whole study area is given in Table 3.

Data treatment—formulae used

Frequency

The percentage frequency of occurrence of a species x in a given category (biome or study area) y was calculated as follows:

$$\text{frequency} = \frac{\text{No. of watercourse recordings/road transects in category y having species x}}{\text{total no. of watercourse recordings/road transects in category y}} \times 100$$

TABLE 2.—Abundance ratings

Rating	Roadsides and veld	No.*	Streambanks	Rating
9	A virtually continuous, almost pure stand	1000+	Any number, with cover more than 75% of the reference area	7
8	The commonest species in a generally continuous tree or shrub layer	500–999	Any number, with 50–75% cover	6
7	Less abundant than above but greater than 20 individuals or groups per km	200–499	Any number, with 25–50% cover	5
			Any number, with 5–25% cover	4
6	10–20 individuals or groups per km	100–199	Numerous, but less than 5% cover or scattered, with cover up to 5%	3
5	5–10 individuals or groups per km	50–99		
4	2–5 individuals or groups per km	20–49	Few, with small cover	2
3	± 1 individual or group per km	5–19	Solitary, with small cover	1
2	Less abundant than above but more than 1 individual or group per 5 km	2–4		
1	± 1 plant or group per 5–10 km	1		

* Approximate numbers of individuals/groups per 10 km transect.

TABLE 3.—Sampling coverage of each biome, Acocks Veld Type grouping and the study area

Biome and Acocks Veld Type grouping	¼ degree squares	Road transects	Distance (km)*	Watercourse recordings
Savanna Biome	63	139	1 107	87
Tropical bush and savanna	60	129	1 031	74
Karoo and False Karoo	7	10	76	13
Nama-Karoo Biome	30	59	483	107
Tropical bush and savanna	25	47	383	66
Karoo and False Karoo	8	11	100	41
Study area	90	198	1 590	194

* This represents the distance along which abundance recordings were made. Total distance along which observations were made is approximately 1,3 times that given.

Prominence value

The prominence value is a combined measure of a species' frequency and abundance relative to that of all other species within a given category (biome or study area).

In streambank habitats the prominence value for species x in category y was calculated as follows:

$$\text{prominence value} = \frac{\text{total weighted abundance of species x in category y}}{\text{sum of the weighted abundances of all species in category y}} \times 100 + \frac{\text{frequency of species x in category y}}{\text{sum frequency of all species in category y}} \times 100$$

The abundance ratings were weighted according to the minimum percentage cover in each scale rating (see Table 2). Thus ratings 7, 6, 5 and 4 had weighted values of 75, 50, 25 and 5 respectively. Ratings 1, 2 and 3 each had weighted values of 1.

In roadside and veld habitats the prominence value for a species x in category y was calculated as follows:

$$\text{prominence value} = \frac{\text{total abundance* of species x in category y}}{\text{sum of the abundances* of all species in category y}} \times 100 + \frac{\text{frequency of species x in category y}}{\text{sum frequencies of all species in category y}} \times 100$$

Mean species abundance rating in roadside and veld habitats (see Table 7)

The mean abundance rating** of species x in a given category (biome or study area) y was calculated as follows:

$$\text{mean no. of individuals or groups per 10 km} = \frac{\text{total no. of individuals or groups of species x in category y}}{\text{total distance along which species x was rated in category y}} \times 10$$

Mean abundance of invaders per km in roadside and veld habitats (see Table 5 and Figure 4)

The mean abundance of invaders per kilometer in a given category (biome or study area) y/quarter degree square z was calculated as follows:

$$\text{Mean abundance} = \frac{\text{total abundance* of all species in category y/quarter degree square z}}{\text{total kilometres rated for abundance estimates in category y/quarter degree z}}$$

RESULTS

The survey yielded 23 naturalized alien species. These species are listed in the Appendix together with a further 13 species of trees and large shrubs which were obtained from Gubb (1985) and Brown & Gubb (1986). The distributions and high abundance areas of the 12 most prominent species are given in Figure 6.

In previous surveys the results were presented for each biome and their constituent veld type categories based on Acocks's Veld Type groupings. In this survey the results are only presented for each of the biomes as a whole. There are two reasons. Firstly, insufficient data was obtained for the separate analysis of the Karoo and False Karoo veld type categories. Secondly, as can be deduced from the introduction, Acocks's Veld Type categories are in need of revision in the study area.

The streambank habitat

The whole study area

One hundred and ninety four watercourse crossings were sampled in which 14 species were recorded, with up to eight species in one sample (Table 4). Invaders were present at 46,4% of all crossings and 7,2% of all crossings were heavily invaded (Table 4).

* each abundance rating was expressed in numbers of individuals or groups recorded per transect (see Table 2). To be both conservative and consistent the minimum number was used in each instance, e.g. an abundance rating of 5 over ten kilometres = 50 and an abundance rating of 5 over five kilometres = 25.

** mean no. of individuals or groups per 10 km converted to rating (see Table 2).

TABLE 4.—Streambank statistics for each biome and the study area

Biome	Total no. of spp.	Average no. of spp./crossing	Max. no. of spp./crossing	% crossings heavily invaded*	% crossings invaded**
Savanna Biome	12	0,7	4	3,4	40,2
Nama-Karoo Biome	10	0,7	8	10,3	51,4
Study area	14	0,7	8	7,2	46,4

* 1 or more species scored an abundance rating of 5 or more.
** invaders present.

TABLE 5.—Statistics for roadside and veld habitats in each biome and the study area

Biome	Total no. of spp.	Average no. of spp./¼° sq.	Max. no. of spp./¼° sq.	% transects invaded	% transects heavily invaded*	Mean abundance of invaders per km**
Savanna Biome	19	3,1	10	88,5	3,6	0,8
Nama-Karoo Biome	7	1,4	4	81,4	25,4	3,4
Study area	20	2,6	10	86,4	10,1	1,6

* 1 or more species scored an abundance rating of 5 or more.
** see data treatment—formulae used.

TABLE 6.—Alien species occurring in streambank habitats

Biome	Savanna Biome			Nama-Karoo Biome			Total study area		
No. watercourse crossings	87			107			194		
	F	I	P	F	I	P	F	I	P
Arundo donax	2,3		4,9	1,9		3,2	2,1		3,6
Eucalyptus sp. cf. *camaldulensis*	2,3	1,1	22,3	0,9		1,5	1,5	0,5	4,9
spp.	4,6		9,8	*			2,1		3,6
Melia azedarach	11,5		24,5	0,9		1,5	5,7		9,8
Nicotiana glauca	13,8	1,1	49,7	8,4		13,9	10,8	0,5	21,1
Opuntia ficus-indica	3,4		7,3				1,5		2,6
Parkinsonia aculeata	1,1		2,4				0,5		0,9
Populus sp. cf. *deltoides*	1,1		2,4				0,5		0,9
Prosopis spp.	13,8	1,1	49,7	48,6	10,3	173,8	33,0	6,2	139,6
Ricinus communis				0,9		1,5	0,5		0,9
Salix babylonica	6,9		14,7	0,9		1,5	3,6		6,2
Schinus molle	5,7		12,2				2,6		4,5
Tamarix sp.?				1,9		3,1	1,0		1,6

F = % frequency of occurrence; I = % crossings heavily invaded; P = prominence value; * species occurring in the given category but not included in a formal recording at a watercourse crossing.

Analysis according to veld type

There was more invasion in the Nama-Karoo Biome than the Savanna Biome in terms of percentage crossings invaded and percentage crossings heavily invaded (Table 4).

Analysis according to species

Frequency

Only *Nicotiana glauca* and *Prosopis* spp. were recorded at 10% or more crossings in the whole study area (Table 6). *Prosopis* spp. were by far the most frequently encountered species in the whole study area (33,0%) and particularly in the Nama-Karoo Biome (48,6%). They were much less frequent in the Savanna Biome (13,8%) but were still, along with *Nicotiana glauca* (13,8%) and *Melia azedarach* (11,5%), the most frequently recorded species.

Prominence

Prosopis spp. were the most prominent invaders in the study area with a prominence value of 139,6 out of a combined total for all species of 200 (Table 6). They were particularly prominent in the Nama-Karoo Biome where they were heavily invasive (i.e. scored an abundance rating of 5 or more) at 10,3% of all watercourse crossings (Table 6). Only *Eucalyptus* sp. cf. *camaldulensis* and *Nicotiana glauca* were also recorded as heavily invasive but much less frequently (Table 6).

Roadside and veld habitats

The whole study area

Ninety quarter degree squares and 198 road transects were sampled in which 20 species were recorded. Up to 10 species were recorded per quarter degree square. Invaders were recorded in 86,4% of all road transects sampled and 10,1% of all transects were heavily invaded (Table 5).

Analysis according to veld type

More invasion was recorded in the Nama-Karoo Biome than in the Savanna Biome in terms of percentage transects heavily invaded and the mean abundance of invaders per km. However, more species were recorded and a greater percentage of road transects were invaded in the Savanna Biome (Table 5).

Analysis according to species

Frequency

The most frequently recorded species in the study area were: *Prosopis* spp. (54,5%), *Opuntia ficus-indica* (41,9%), *Melia azedarach* (18,7%) and *Nicotiana glauca* (12,6%) (Table 7).

Prosopis spp. with a percentage frequency of 81,4% were by far the most frequently recorded species in the Nama-Karoo Biome. They were the only species to be recorded in more than 10% of all transects in the biome.

The most frequently recorded species in the Savanna Biome were *Opuntia ficus-indica* (56,8%), *Prosopis* spp. (43,2%) and *Melia azedarach* (26,6%). Other species which were less frequent but which were recorded in more than 10% of all transects were *Nicotiana glauca, Opuntia* sp. cf. *robusta* cultivars and *Agave americana*.

Prominence

Prosopis spp. scored the highest prominence values in the whole study area (109,8) and in the Nama-Karoo Biome (186,5) (Table 7). *Opuntia ficus-indica* was the most prominent invader in the Savanna Biome with a prominence value of 65,2 followed by *Prosopis* spp. and *Melia azedarach*.

Prosopis spp. were the only species recorded as heavily invasive (i.e. scored an abundance rating of 5 or more) in the Nama-Karoo Biome. In the Savanna Biome *Prosopis* spp., *Opuntia ficus-indica* and *Nicotiana glauca* were the only species recorded as heavily invasive.

Patterns of invasion

In roadside and veld habitats there was a general trend for increased species diversity of alien woody invaders from the arid west to the less arid east (Figure 3). In streambank habitats there was no clear west-east trend (Figure 4) but rather a trend for increased species diversity from dry or seasonal rivers to perennial rivers. For example, only three species were recorded along the Kuruman, Molopo amd Nossob Rivers while up to nine species were recorded along each of the Orange and Vaal Rivers and a combined total of 13 species along both rivers.

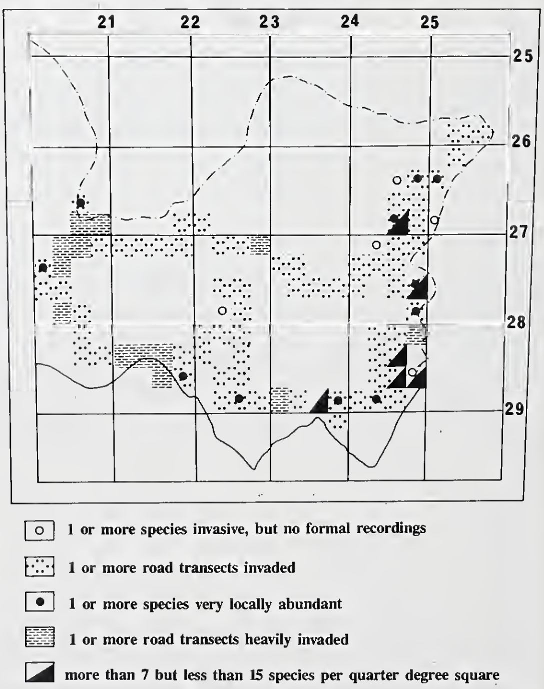
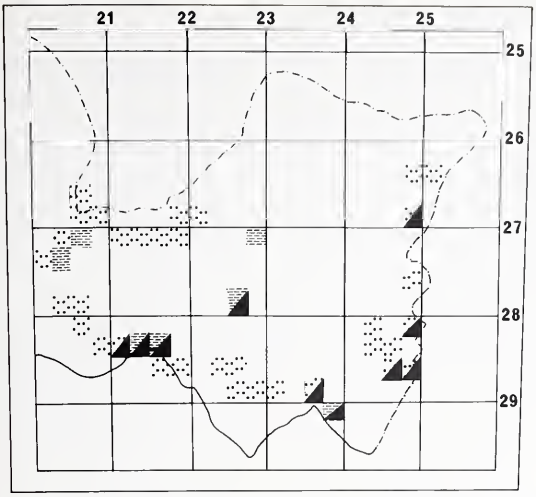


FIGURE 3.—Invasion in roadside and veld habitats in terms of the intensity of invasion of road transects and species diversity per quarter degree square.



1 or more river crossings invaded

1 or more river crossings heavily invaded

more than 3 but less than 10 species per quarter degree square

FIGURE 4.—Invasion in streambank habitats in terms of the intensity of invasion of watercourse crossings and species diversity per quarter degree square.

Heavily invaded watercourses and road transects were almost entirely due to infestations of *Prosopis* spp. The details regarding infestations of *Prosopis* spp. are given in Table 8. Heavily invaded road transects occurred almost exclusively where roads travelled were either adjacent to seasonal or perennial watercourses such as at Upington, Douglas and Hotazel or in dry riverbeds such as along the Molopo and Kuruman Rivers (Figures 3 & 5). The most severe invasion of watercourses in terms of the abundance of invaders was recorded along the dry riverbed of the Molopo River south of Witdraai and along dry or seasonal tributaries of the Orange River between Upington and Grootdrink (Figure 4, Table 8).

DISCUSSION

Sampling level achieved and validity of results

The sampling level achieved (31,9%) was considerably less than in previously surveyed regions (Transvaal—60%, Natal—87%, and Orange Free State—66%). This was considered justifiable due to the greater aridity and uniformity of the indigenous vegetation, smaller human population and lesser development of the present study area compared to previously surveyed regions. Previous studies have shown that one can expect less invasion in drier regions and in areas with less disturbance (Henderson & Musil 1984; Henderson 1989, 1991).

The survey route was carefully designed to cover a wide area, to traverse all major veld types and to sample as wide a range of habitats as possible. More extensive sampling of the perennial rivers, which appear to be the habitats most susceptible to invasion, would have been desirable. It may be possible to extend this coverage *en route* to the central and western Cape regions which are to be surveyed at a later date.

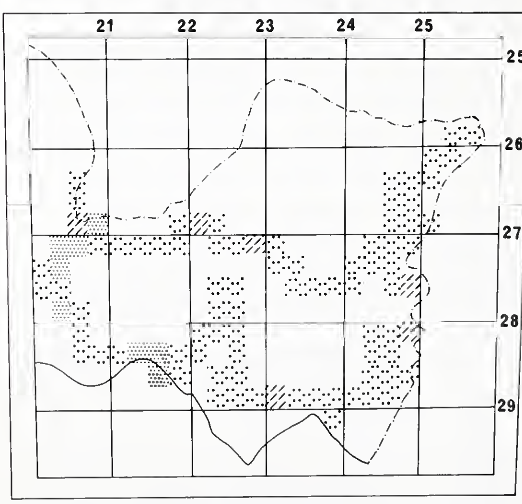
The tall grass cover over most of the study area at the time of the survey made it difficult to see certain species, particularly the low-growing *Opuntia* spp. It is suspected that the presence of these species was sometimes overlooked and their abundances underestimated.

Prominent and potentially important species

Most invasion in the study area can be attributed to *Prosopis* spp. The identification of the taxa within this genus is difficult because the characteristics used in identification (details of the leaflets, pods and spines) vary under different climatic conditions and there is evidence of hybridization (Harding 1987). As a result of these difficulties all invasive taxa of *Prosopis* have been referred to as *Prosopis* spp. in the results of this survey. However, some specimens were collected and these were identified as *P. glandulosa* var. *glandulosa*, *P. glandulosa* var. *torreyana* and *P.* cf. *velutina*.

P. glandulosa var. *glandulosa* appeared to be the least invasive and this is in agreement with findings by Harding (1987). *P. glandulosa* var. *torreyana* appeared to be the most prominent invader in the densely infested area along the Molopo River south of Witdraai. *P.* cf. *velutina* and *P. glandulosa* var. *torreyana* were prominent in the Upington area. According to Harding (1987), *P. velutina* is invasive in the Mafikeng area.

At least four other species of *Prosopis* have been introduced into southern Africa, the earliest known introduction date being 1879 or before (Poynton 1990). They were mainly introduced as a source of fodder, as they produce highly nutritious pods, and for shade (Harding 1987; Poynton 1990). In Leistner's (1967) study of the plant ecology of the southern Kalahari, which includes the major part of the Nama-Karoo Biome covered in the present survey, there is no mention of *Prosopis* spp.



Mean abundance per km:

Less than 2 individuals/groups

2–4 5–20

FIGURE 5.—Invasion in roadside and veld habitats in terms of the mean abundance of invaders per kilometre in each quarter degree square.

TABLE 7.—Alien species occurring in roadside and veld habitats

Biome	Savanna Biome			Nama-Karoo Biome			Total study area		
No. road transects	139			59			198		
	F	A	P	F	A	P	F	A	P
Agave									
americana	10,8	1,0	7,5				7,6	1,0	5,3
Arundo									
donax	2,2	1,0	1,5				1,5	1,0	1,0
Atriplex									
nummularia				1,7	2,0	1,9	0,5	2,0	0,4
Caesalpinia									
gilliesii	1,4	1,0	0,9				1,0	1,0	0,7
Eucalyptus									
spp.	2,2	2,0	1,7				1,5	2,0	1,1
Gleditsia									
triacanthos	*						*		
Melia									
azedarach	26,6	2,0	20,4				18,7	2,0	13,8
Nicotiana									
glauca	16,5	2,0	14,9	3,4	1,0	3,8	12,6	2,0	10,1
Opuntia									
ficus-indica	56,8	2,0	65,2	6,8	1,0	7,7	41,9	2,0	38,7
imbricata	5,0	1,0	3,7				3,5	1,0	2,5
rosea	0,7	2,0	0,6				0,5	2,0	0,4
sp. cf. *robusta*	11,5	1,0	8,4	*			8,1	1,0	5,8
stricta	2,2	1,0	1,5				1,5	1,0	1,0
Parkinsonia									
aculeata	0,7	1,0	0,5				0,5	1,0	0,4
Populus									
sp. cf. *deltoides*	3,6	3,0	7,2				2,5	3,0	3,4
Prosopis									
spp.	43,2	3,0	58,2	81,4	4,0	186,5	54,5	4,0	109,8
Ricinus									
communis	1,4	1,0	0,9				1,0	1,0	0,7
Schinus									
molle	7,2	1,0	5,3				5,1	1,0	3,7
Trichocereus									
sp. cf. *spachianus*	2,2	1,0	1,6	*			1,5	1,0	1,1

F = % frequency of occurrence; A = mean abundance rating; P = prominence value; * species occurring in the given category but not included in formal recordings in a road transect.

TABLE 8.—The most severe infestations of *Prosopis* spp.

1/4 degree square	Locality	Abundance rating/recording: Road transects	Abundance rating/recording: River crossings
2620 DC	Andriesvale, along Molopo River	5 over 7 km	
2620 DD	Askham, along Kuruman River	6 over 10 km	
2622 CC	Vanzylsrus, along Kuruman River	6 over 5 km	
2720 AB	Between Loch Maree and Linlithgow, along Molopo River	6 over 10 km	
2720 AD	Koopan-Suid, along Molopo River (at least 5 km of dense infestation)	7 over 10 km	7 (× 1)
2720 BA	Bonus to Loch Maree, along Molopo River (at least 6 km of dense infestation between Inkbospan and Loch Maree)	7 over 20 km	7 (× 1)
2720 CD	Vrouenspan to Soutpanputs	5 over 5 km 6 over 5 km 7 over 5 km	
2722 BB	Hotazel, along Ga-Mogara River	6 over 5 km	5 (× 1)
2821 AC	Upington, outskirts of town	5 over 5 km	
2821 AD	Upington-Grootdrink road, along Orange River	5 over 10 km 6 over 10 km	7 (× 6)
2821 BC	Upington-Grootdrink road, along Orange River	5 over 10 km 6 over 10 km	7 (× 2) 6 (× 1)
2821 DA	Upington-Grootdrink road, along Orange River	7 over 5 km	
2823 CC	Griquatown	6 over 5 km	

being naturalized and only *P. chilensis* is mentioned as a cultivated plant. Leistner (pers. comm. 1990) confirms that at the time of his survey (1957–1963) there were no thickets of *Prosopis* spp.

Invasions of *Prosopis* spp. only became obvious between 1976/77 and 1985 (Macdonald 1985). Macdonald (pers. comm.) has concluded that this was probably an episodic invasion event correlated with the exceptionally good conditions for establishment of seedlings during the high rainfall event of the 1970s.

Prosopis spp. have been estimated to cover an area of 200 000 ha in the north-western Cape, centred around Vanwyksvlei and Kenhardt (Harding 1987), which are situated to the south of the study area under discussion here. The habitats favoured are areas where ground water is assured and which 'unfortunately' are also the most fertile habitats in these arid regions (Harding 1987).

In the present study *Prosopis* spp. were most abundant along the dry riverbeds of the lower Molopo and Kuruman Rivers and tributaries of the Orange River between Upington and Grootdrink (Figure 6). The most extensive stands of *Prosopis* spp. were noted along the Molopo River. Since roads closely follow watercourses in this region, *Prosopis* spp. scored high abundance ratings in roadside as well as veld habitats. They were not confined to the riverbed of the Molopo River but in places had invaded dune valleys and the lower slopes of dunes.

Prosopis seed germination is enhanced by its passage through the digestive tract of animals (Harding 1987). This feature and the prolific seed production of the invasive *Prosopis* spp., and the effective dispersal of seed by water, domestic stock and a wide range of indigenous animals (Brown & Gubb 1986), all favour the further expansion of these species. All watercourses are potentially at risk from invasion by *Prosopis* spp. and it is predicted that without drastic control measures dense infestations could develop along large stretches of the Molopo and Kuruman Rivers. Cultivation along the banks of the Orange River could prevent the development of dense stands but seed washed down to the very arid uncultivated lower reaches of the river outside of the study area could also result in infestations of *Prosopis* spp.

A study of water-stress patterns in *P. glandulosa* var. *glandulosa* by Haas & Dodd (1972) showed that this species, while 'an extravagant user of readily available water', can protect itself from excessive stress when soil water becomes limiting. This drought-endurance mechanism together with its seed dispersal by many animals suggests that *Prosopis* spp. may have the potential to spread beyond watercourses to drier sites.

Hybridization could also result in the selection of hardy forms that can invade progressively more arid habitats. Already there have been observations of 'habitat-linked natural segregation' of hybrid swarms (Poynton 1990). 'Where mixed populations have colonised watercourses, site variation exercises a selective influence on genotype performance and survival, segregants resembling *P. chilensis* tending to dominate on deep, alluvial soils with a comparatively high water table, those resembling *P. glandulosa* var. *torreyana* occupying mesic situations and those with the velvety hairs of *P. velutina* being found mostly on dry, stony slopes' (Poynton 1990).

There appears to be little information on the ecological impacts of invasive *Prosopis* spp. The dense stands that flourish where ground water is available such as along the Molopo River, and the evidence provided by Haas & Dodd (1972) concerning the 'extravagant' water use by *P. glandulosa* var. *glandulosa*, leads one to speculate that *Prosopis* spp. could have a major impact on the hydrology of the ecosystems they invade.

Prosopis spp. were originally planted to provide shade and fodder for livestock. However, where thickets have developed, pod production has decreased (H.G. Zimmermann pers. comm.) and the dense, thorny growth not only restricts the movement of livestock but also results in their injury and even death (R. Price pers. comm.).

Cattle ranching areas in the Savanna Biome could be threatened by invasive *Prosopis* spp. Studies by Brown & Archer (1989) in south-western North America have shown that seedling emergence and survival of *P. glandulosa* var. *glandulosa* in grasslands is enhanced by herbaceous defoliation regardless of grazing history. They have a hypothesis that the recent invasion of grasslands in south-western North America by *P. glandulosa* var. *glandulosa* is related to the introduction of cattle and the effective dispersal of large quantities of viable seeds away from the riverine systems to which they were largely confined.

In an integrated approach to the control of *Prosopis* spp., research has been directed towards chemical and biological control and a means of utilizing the plants as a source of fodder, honey, pulp and firewood (G.B. Harding pers. comm.). The first releases of the seed-feeding beetle *Algarobius prosopis* were made in December 1987 and by August 1989 there were favourable reports concerning their dispersal from release sites and damage caused to *Prosopis* seeds (Olckers & Harding 1989).

Several *Opuntia* spp. were recorded in the study area and these occurred mainly or only in the Savanna Biome. *Opuntia ficus-indica* was the most frequently recorded species. Although it was widespread, it was rarely abundant. Both spiny and spineless forms were recorded. The smaller *Opuntia* spp. may have been underestimated, since they were difficult to see amongst the tall grass cover that prevailed over most of the study area. *O. stricta* is known to be abundant on several farms in the Stella area (H.G. Zimmermann pers. comm.) but only a few plants were seen scattered along roadsides during the survey. *O. rosea* has long been known to infest several farms in the Douglas District (Stirton 1978) but only a few plants were visible from the road. This species has also been noticed at Vryburg, Jan Kempdorp and Hartswater (De Beer 1986a) and at Kathu (M.J. Wells pers. comm.). *O. imbricata* is also likely to have been underestimated. *O. aurantiaca* was not seen during this survey but is known to be invasive in the south-eastern parts (Brown & Gubb 1986; Stirton 1978). All the *Opuntia* spp. recorded during this survey, with the exception of the blue-leaved cultivars (*O.* cf. *robusta* varieties), are the targets of biological control programmes. There has been substantial control of *O. imbricata* and *O. ficus-indica* (Zimmermann *et al.* 1986).

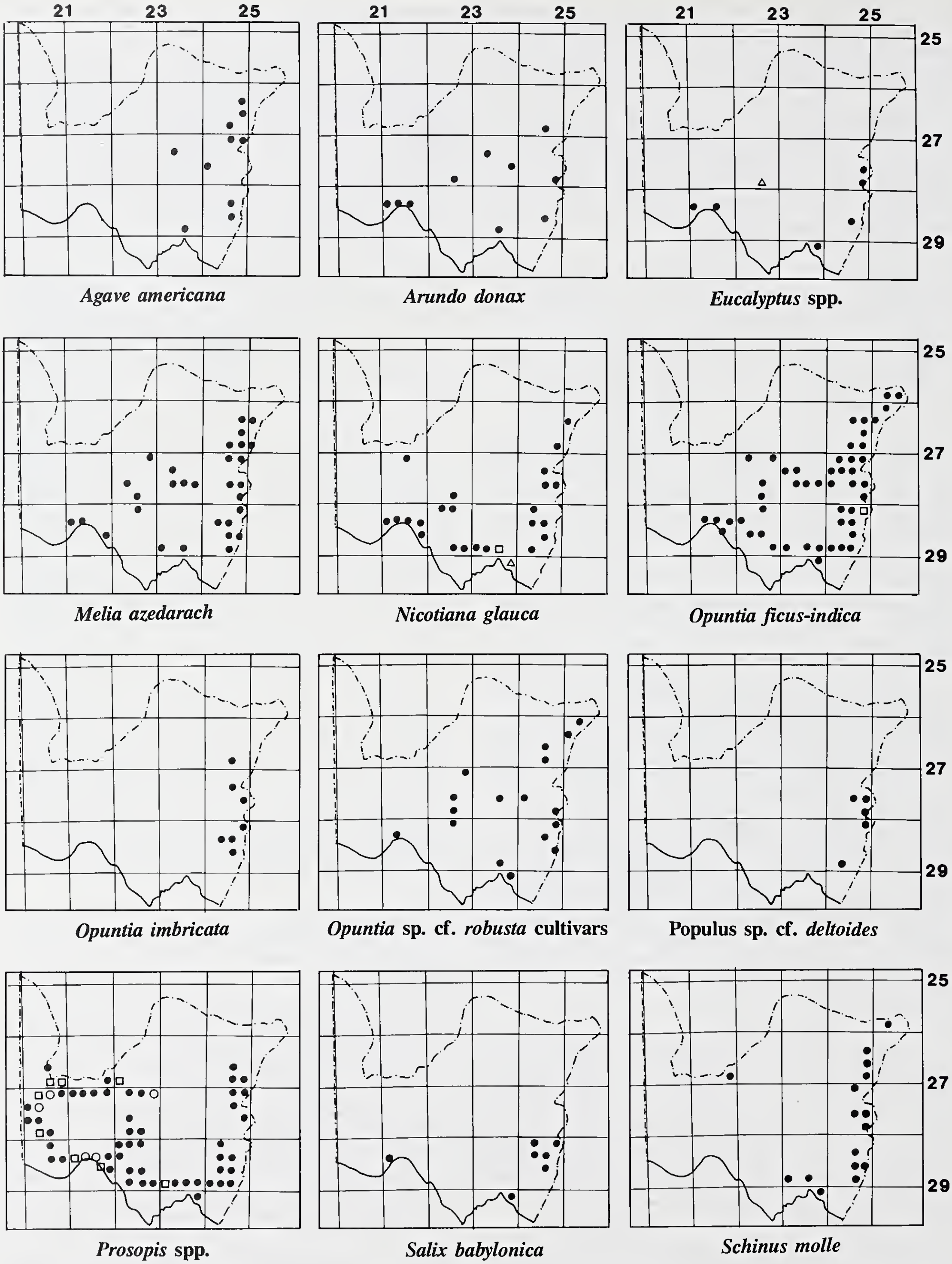


FIGURE 6.—Distribution of the most prominent species. Highest abundance rating of 4 or less: ●. Highest abundance rating of 5 or more: roadside and veld habitats, □; streambank habitats, △; streambank, roadside and veld habitats, ○.

A small cactus, possibly *Trichocereus spachianus*, which has been planted as a hedge and for ornament, has escaped locally. The much larger *Cereus peruvianus* (= cf. *jamacaru* fide H.F. Glen pers. comm.) which is invasive in the Savanna Biome of the Transvaal (Taylor & Walker 1984; Henderson & Wells 1986), and reported by Brown & Gubb (1986) as invasive in the northern Cape savanna, was rarely seen and only as a cultivated plant. These species should be regarded as potentially important invaders and naturalized plants should be eradicated. Since *C. peruvianus* is a declared weed in South Africa (Republic of South Africa 1984) all cultivated plants of this species should also be eradicated.

Nicotiana glauca is widely naturalized in southern Africa and in South Africa the greatest densities of plants occur in the dry western and central parts of the Cape (Stirton 1978). It is exceedingly abundant along the lower reaches of the Orange River through the Richtersveld (pers. obs.) and dense infestations occur along the lower 20 km of the Ugab River in northern Namibia (Brown & Gubb 1986). In the study area it was mostly recorded as isolated plants or small groups of plants in disturbed places such as along roadsides and road cuttings, around habitations, on piles of rubble and along perennial and seasonal watercourses.

Most *Eucalyptus* spp. were confined to the immediate surroundings of habitations and plantations. However, *Eucalyptus* sp. cf. *camaldulensis* was recorded along watercourses far from any plantings. According to Brown & Gubb (1986) *E. camaldulensis* and *E. microtheca* are highly invasive in the northern Cape savanna. Apart from their occurrence in virtually all habitats disturbed by human agency they have invaded naturally disturbed and undisturbed habitats. These include dry river alluvium, episodic river banks, rocky and sandy habitats, and islands in perennial rivers (Brown & Gubb 1986).

Most records of *Melia azedarach* were of isolated plants or small groups of plants. This species was largely confined to the Savanna Biome where it occurred most frequently along roadsides and around habitations, but it also occurred along perennial and seasonal watercourses. It was only recorded along the Orange River in the Nama-Karoo Biome. It could become an important invader of perennial rivers judging by its success in these habitats in other parts of South Africa (Henderson & Musil 1984; Henderson 1989).

Salix babylonica is widely naturalized along watercourses in the Grassland Biome of South Africa (Henderson in press). In the study area it was recorded mainly along the Vaal River in the Barkly West District. Since it only propagates vegetatively from detached branches (Henderson in press) its further spread in the study area will be limited to perennial and seasonal watercourses.

Arundo donax occurred mainly as small groups of plants along the Orange and Vaal Rivers and occasionally along roadsides, around habitations, and at watering points. Since it is very similar in appearance to the indigenous reeds (*Phragmites* spp.), there is a danger that it will spread unnoticed. It is capable of forming dense stands by propagating vegetatively from rhizomes. In the study area it may also spread from seed, since flowering plants were seen at Upington.

Agave americana was seen only in the immediate vicinity of habitations. It appears to propagate mainly vegetatively from suckers and bulbils in South Africa. Its spread is therefore very restricted except where plants may be dispersed by floodwaters.

Populus sp. cf. *deltoides* was only prominent between Jan Kempdorp and Taung in the Vaalharts irrigation scheme area where it has been planted as a windbreak for at least 20 km. Spread from this windbreak was restricted mainly to the adjacent veld and roadside. Its presence on islands within perennial rivers (pers. obs.; Brown & Gubb 1986) indicates that this species is also capable of invading habitats undisturbed by human activities.

Schinus molle was confined to the Savanna Biome. It was most frequently recorded along roadsides and in disturbed sites around habitations and mining areas but was also seen along watercourses. Its popularity as a shade and ornamental tree, its hardiness to drought and frost and its fleshy fruits which are attractive to birds (Ridley 1930) are all factors that should favour the further spread of this species. The same predatory wasp that has been found in the seeds of *Schinus terebinthifolius* and which may have prevented it from becoming a serious weed in Natal, has been found in the seeds of *S. molle* in various parts of South Africa (S. Neser pers. comm.). This wasp, however, appears to damage fewer seeds of *S. molle* than of *S. terebinthifolius* (S. Neser pers. comm.).

Relation of invasion to environmental factors

The greatest abundance and diversity of alien invader plants were recorded in disturbed sites near human settlements, such as the outskirts of towns, villages and farm homesteads. *Prosopis* trees planted in the dry riverbeds of the Molopo and Kuruman Rivers for shade and fodder are probably the major source of the infestations in these sites. Domestic livestock, wild animals and occasional floodwaters would all have assisted in the dispersal and germination of *Prosopis* seed.

Evidence that *Prosopis* seed is dispersed by episodic floodwaters in the southern Kalahari comes from the Kalahari Gemsbok Park. Macdonald (1985) reports that regular clearing operations have to be undertaken to remove *Prosopis* trees which come from seed washed in from Namibia during flood years. Seed germination of *Prosopis* spp. is also only likely to occur after rains or river floods. These conditions are necessary for the germination of indigenous plants in the southern Kalahari as the moisture supplies in the upper soil layers are otherwise inadequate (Leistner 1967).

There have been at least four major flooding events in the southern Kalahari this century. These were in 1918, 1934, 1963 (Leistner 1967) and 1972–1976 (Anon. 1974a; Van der Walt 1976). Although the floodwaters reached the lower Molopo River in the first three instances, there were no *Prosopis* infestations recorded until after the run of high rainfall and flooding events of the 1970s (Kruger *et al.* 1986; Macdonald 1985). Exceptional rainfall was recorded in the Kalahari Gemsbok Park in 1974–1976 (Anon. 1974a & b; Rodrigues 1987; Van der Walt 1976). The Auob River flowed in five consecutive years from 1972–1976 (Anon. 1974a; Rodrigues 1987), the Nossob in at least two years, 1972 and 1974 (Anon. 1974a). The Kuruman River flowed for the first time in living memory in 1974 and again in 1975 and 1976, reaching the lower Molopo River at Andriesvale in each instance (Haagner 1976).

Perennial rivers not only provide a reliable means of dispersal for alien species, but conditions in the streambank habitat may also play a role in reducing water stress and thereby allowing acclimatization to the arid climate. Most of the alien species which have spread far from plantings have done so along watercourses. These include *Nicotiana glauca*, *Eucalyptus* sp. cf. *camaldulensis*, *Prosopis* spp., *Melia azedarach* and *Salix babylonica*.

Humans and animals are the most important agents in the dispersal of the *Opuntia* spp. (H.G. Zimmermann pers. comm.). *O. ficus-indica*, the most widespread species, reproduces both vegetatively from detached plant parts, and from seed which is dispersed by humans, baboons, cattle and possibly other animals. *O. stricta* is very localized at present, which suggests that only *in situ* vegetative propagation from plant fragments has occurred. Its fruits are sour and therefore likely to be less attractive to humans and animals than the fruits of *O. ficus-indica*. However, it is dispersed by baboons in the Kruger National Park (K. Maggs pers. comm.), and in Australia, where it became a major pest, it was spread by many species of birds and animals (Mann 1970).

Opuntia rosea and *O. imbricata* are spread vegetatively from plant fragments which are easily detached. Barbed hooks on the spines enable these fragments to become easily attached to passing humans and animals. *O. rosea* can also be dispersed by farm implements and vehicles (De Beer 1986a, b).

CONCLUSION

Several factors have contributed to the relatively low level of alien plant invasion in the northern Cape. The most important of these are the arid climate and extremes of temperature which have drastically limited the number of alien species that could be grown here successfully. Compared to the regions further east, there has been little agricultural development and human settlement and hence fewer propagules of alien plants and less disturbance of the natural plant cover.

The invasive *Prosopis* spp. are a cause for major concern. All watercourses are potentially at risk from invasion by these species and there is a possibility that they may spread to drier sites. Already they have formed dense stands along stretches of the Molopo and Kuruman Rivers and tributaries of the Orange River. Dense stands along the episodic rivers could have a serious impact on the hydrology of these ecosystems. This, together with the impenetrability of the infestations and injuries caused to livestock, could threaten the livelihood of farmers along these watercourses.

The *Opuntia* spp. known to be invasive in this region are not considered to be a serious problem since various methods of control are available for all of them. The danger lies in their uncontrolled spread and this applies particularly to *O. rosea* for which there is no effective biological control at this stage (H.G. Zimmermann pers. comm.). There is also a danger that new species of *Opuntia* or other genera of the family Cactaceae may become invasive.

The perennial rivers have been invaded by a spectrum of alien species and the intensity of invasion is likely to increase in the future. Until studies have been undertaken to assess the ecological impacts of these invaders, efforts should be made to control the spread of all alien plant species along rivers and to discourage the planting of alien trees along riverbanks.

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APPENDIX

The names of 36 species of naturalized alien trees and shrubs are listed. Some non-woody species are included. Names and dates in brackets: literature references.

Agave americana L., century plant
Arundo donax L., giant reed
Atriplex nummularia Lindl., saltbush
Caesalpinia gilliesii (Wall. ex Hook.) Benth., bird-of-paradise
Cannabis sativa L. (Brown & Gubb 1986), dagga
Casuarina equisetifolia G. Forst. (Brown & Gubb 1986), horsetail tree
Cereus peruvianus (L.) Mill. [= cf. *jamacaru* DC. (fide H.F. Glen, pers. comm.)] (Brown & Gubb 1986), queen of the night
Crotalaria juncea L. (Brown & Gubb 1986), deccan hemp
Eucalyptus
 camaldulensis Dehnh. (Brown & Gubb 1986), red gum
 microtheca F. Muell. (Brown & Gubb 1986)
 *sideroxylon*A. Cunn. ex Woolls (Brown & Gubb 1986), black ironbark
Gleditsia triacanthos L., honey locust
Melia azedarach L., syringa
Nicotiana glauca R.C. Grah., wild tobacco
Opuntia
 aurantiaca Lindl. (Brown & Gubb 1986), jointed 'cactus'
 ficus-indica (L.) Mill., sweet prickly pear
 imbricata (Haw.) DC., imbricate prickly pear
 rosea DC., rosea 'cactus'
 stricta Haw., pest pear of Australia
 sp. cf. *robusta* cultivars
Parkinsonia aculeata L., Jerusalem thorn
Physalis peruviana L. (Brown & Gubb 1986), Cape gooseberry
Populus deltoides Bartr. ex Marsh. (Brown & Gubb 1986), match poplar
Prosopis
 glandulosa Torr.
  var. *glandulosa*, mesquite
  var. *torreyana* (Benson) Johnston
 sp. cf. *velutina* Wooton, velvet mesquite
 spp. [possibly *P. chilensis* (Mol.) Stuntz, *P. juliflora* (Swartz) DC. and *P. pubescens* Bentham according to Gubb (1985)]
Ricinus communis L., castor-oil plant
Salix babylonica L., weeping willow
Schinus molle L., pepper tree
Sesbania punicea (Cav.) Benth. (Brown & Gubb 1986), red sesbania
Tamarix
 ramosissima Ledeb. (Brown & Gubb 1986), pink tamarisk
 ? sp.
Trichocereus cf. *spachianus* (Lemaire) Riccobono

Bothalia 21,2: 191–213 (1991)

New taxa, new records and name changes for southern African plants

B.C. DE WET, R. ARCHER, L. FISH, G. GERMISHUIZEN, P.P. HERMAN, M. JORDAAN, S.M. PEROLD, C. REID, J. VAN ROOY, W.G. WELMAN and H.F. GLEN*

ABSTRACT

Additions and alterations to the inventory of about 26 000 plant taxa in southern Africa are reported for the period from February 1990 to February 1991. In this period a total of 1 080 alterations have been recorded. These changes result from the continual surveying of taxonomic literature received by the library of the National Botanical Institute.

UITTREKSEL

Daar word vir die tydperk vanaf Februarie 1990 tot Februarie 1991 verslag gedoen oor byvoegings en veranderings aan die lys van omtrent 26 000 planttaksons wat in suider-Afrika voorkom. Gedurende hierdie tydperk is 'n totaal van 1 080 veranderings aangeteken. Hierdie veranderings word deurlopend in die taksonomiese literatuur wat deur die biblioteek van die Nasionale Botaniese Instituut ontvang word, opgespoor.

INTRODUCTION

This is the seventh annual publication in this series reporting on the complete inventory of southern African plant taxa. This inventory, maintained as the 'Taxon' component of PRECIS (**PRE**toria **C**omputerised **I**nformation **S**ystem), contains an up-to-date record of the taxonomic and nomenclatural history of southern African plant taxa over the latter half of the twentieth century.

In this report year, 1 080 name changes were recorded. The greatest number of changes recorded in a single genus was in *Serruria*, which underwent no less than 65 changes. The format used here to report these changes continues to follow that used in previous lists of this series (De Wet *et al.* 1990 and earlier papers all listed in the references).

The number of changes recorded this year is the largest noted since the start of this series in 1985; this statement could be made of each year except 1986. The exact numbers involved are listed in Table 1.

The 'Taxon' component of PRECIS currently holds the names of about 26 000 taxa, of which slightly over 1 000 are naturalized aliens. This means that there has been an increase of about 1 000 names since last year, and 2 000 names since the completion of the second edition of the List of species of southern African plants (Gibbs Russell *et al.*, 1987). Numerous combinations of names have been published, resulting in the placing of names into synonymy. The continual addition of new taxa and re-assessment of existing taxa emphasise the fact that the flora of southern Africa is relatively unknown. Many of the taxonomic revisions that are undertaken result in the description of new taxa. As the *Flora of southern Africa (FSA)* project is estimated to be only about 14% complete (with recent accounts of about the same proportion of the flora published elsewhere) it may be realistic to predict that over 1 000 unknown plant taxa in southern Africa await formal description!

TABLE 1.— Name changes recorded each year by Taxon-PRECIS

Year	Changes	Notes
1985	403	Name changes of Dicots held over to Gibbs Russell *et al.*, 1987b.
1986	355	
1987	678	
1988	744	
1989	890	
1990	1080	

The National Botanical Institute is currently debating whether the *FSA* should continue to be published in its present form. It has been suggested that a smaller, simpler and possibly machine-readable *Prodromus* to the Flora should be published, based on the list of southern African plant species in PRECIS.

Each contributor is acknowledged at the beginning of the groups for which he/she is responsible. Although staff of the National Botanical Institute, Pretoria, have final responsibility for maintaining Taxon-PRECIS, we acknowledge with gratitude the co-operation of other botanists in reporting changes.

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BRYOPHYTA Contributed by J. van Rooy

HEPATICAE 1000

RICCIACEAE (H8) 1016

1016 –RICCIA L.
1. LEVIER. 1894. BULL. SOC. BOT. ITAL. 5: 114–115.
20. PEROLD. 1990. BOTHALIA 20,2: 197–206.
21. PEROLD. MS. FSA.
200 R. ALBOMARGINATA BISCH. EX KRAUSS
(Note change in author)
R. campbelliana Howe = R. MACROCARPA LEVIER
1000 R. CONCAVA BISCH. EX KRAUSS
(Note change in author)
1500 R. CURTISII (AUST.) STEPH.
(Note change in author)
1675 R. GARSIDEI SIM
1800 R. LIMBATA BISCH. EX KRAUSS
(Note change in author)
1825 R. MACROCARPA LEVIER
(=R. campbelliana Howe) 1
3200 R. STRICTA (LINDENBERG) PEROLD

LEPIDOZIACEAE (H31) 1201

1204 –KURZIA VON MARTENS
2. POCS. 1984. UNIV. KARLOVA PRAHA 107–119.
50 K. CAPILLARIS (SW.) GROLLE
(=K. stephanii (Ren.) Grolle) 2
(=Microlepidozia tabularis (Steph.) S. Arnell) 2
K. stephanii (Ren.) Grolle = K. CAPILLARIS
K. succulenta (Sim) Grolle = TELARANEA SUCCULENTA

1205 –LEPIDOZIA DUM.
2. POCS. 1984. UNIV. KARLOVA PRAHA 107–119.
L. carnosa Steph. = L. PEARSONII
150 L. CUPRESSINA (SW.) LINDENB.
(=L. natalensis Steph.) 2
(=L. truncatella Nees) 2
L. lacerata Steph. = L. PEARSONII
L. natalensis Steph. = L. CUPRESSINA
350 L. PEARSONII SPRUCE
(=L. carnosa Steph.) 2
(=L. lacerata Steph.) 2
L. truncatella Nees = L. CUPRESSINA

1206 –MICROLEPIDOZIA SPRUCE Southern African species moved to KURZIA
M. tabularis (Steph.) S. Arnell = KURZIA CAPILLARIS

1208 –TELARANEA SPRUCE
2. POCS. 1984. UNIV. KARLOVA PRAHA 107–119.
300 T. SUCCULENTA (SIM) GROLLE
(=Kurzia succulenta (Sim) Grolle) 2

DICRANACEAE (8) 1356

1359 –CAMPYLOPUS BRID.
3. CORLEY & FRAHM. 1982. J. BRYOL. 12: 190.
4. FRAHM. 1987. BRYOLOGISCHE BEITRAGE 7: 1–117.
75 C. AUREONITENS (C. MUELL.) JAEG.
(=C. lonchoclados C. Muell. in Geh.) 4
(=C. symonsii Sim) 4
C. basalticolus (C. Muell.) Par. = SPHAEROTHECIUM SUBCHLOROPHYLLOSUM
450 C. CATARRACTILIS (C. MUELL.) PAR.
(=C. pulvinatus (C. Muell.) Par.) 4
C. lonchoclados C. Muell. in Geh. = C. AUREONITENS
C. pallidus Hook. f. & Wils. = C. PYRIFORMIS
C. pulvinatus (C. Muell.) Par. = C. CATARRACTILIS
1650 C. PYRIFORMIS (SCHULTZ) BRID.
(=C. pallidus Hook. f. & Wils.) 3
C. subchlorophyllosus C. Muell. ex Rabenh. = SPHAEROTHECIUM SUBCHLOROPHYLLOSUM
C. symonsii Sim = C. AUREONITENS

1374 –SPHAEROTHECIUM HAMPE
1. FRAHM. 1986. BRYOLOGIST 89,2: 152–154.
100 S. SUBCHLOROPHYLLOSUM (C. MUELL. EX RABENH.) FRAHM
(=Campylopus basalticolus (C. Muell. Par.) 1
(=Campylopus subchlorophyllosus C. Muell. ex Rabenh.) 1

BRYACEAE (24) 1506

1508 –BRYUM HEDW.
B. herpetineuron Ther. (Species does not occur in southern Africa)

BARTRAMIACEAE (37) 1581

1582 –BARTRAMIDULA B.S.G. Southern African species moved to PHILONOTIS
B. comosa Broth. = PHILONOTIS COMOSA
B. globosa (C. Muell.) Broth. = PHILONOTIS GLOBOSA
B. globosa (C. Muell.) Broth. var. tenuicaulis (C. Muell.) Sim = PHILONOTIS GLOBOSA

1584 –PHILONOTIS BRID.
2. GRIFFIN & BUCK. 1989. BRYOLOGIST 92,3: 376.
400 P. COMOSA (BROTH.) GRIFFIN & BUCK
(=Bartramidula comosa Broth.) 2
575 P. GLOBOSA (C. MUELL.) GRIFFIN & BUCK
(=Bartramidula globosa (C. Muell.) Broth.) 2
(=Bartramidula globosa (C. Muell.) Broth. var. tenuicaulis (C. Muell.) Sim) 2

CRYPHAEACEAE (48) 1681

1682 –Forsstroemia Lindb. Genus moved to LEPTODONTACEAE

LEPTODONTACEAE (48A) 1683

1683 –FORSSTROEMIA LINDB.
1. MAGILL. MS. FSA.
100 F. PRODUCTA (HORNSCH.) PAR.

1684 –LEPTODON MOHR
1. MAGILL. MS. FSA.
100 L. SMITHII (HEDW.) WEB. & MOHR.

PTEROBRYACEAE (57) 1731

1734 –ORTHOSTICHOPSIS BROTH.
1. MAGILL. MS. FSA.
200 O. SUBIMBRICATA (HAMPE) BROTH.

NECKERACEAE (60) 1756

1758 –Pinnatella Fleisch. Genus moved to THAMNOBRYACEAE
P. flagellacea (Mitt.) Broth. (species does not occur in southern Africa)

THAMNOBRYACEAE (60A) 1760

1760 –PINNATELLA FLEISCH.
1. MAGILL. MS. FSA.
100 P. OBLONGIFRONDEA (BROTH.) BROTH.

1761 –POROTHAMNIUM FLEISCH.
1. MAGILL. MS. FSA.
P. capense (species insufficiently known)
P. comorense (C. Muell.) Sim = POROTRICHUM ELONGATUM
P. hildebrandtii (C. Muell.) Fleisch. = P. STIPITATUM
P. natalense (C. Muell.) Fleisch. = POROTRICHUM MOLLICULUM
P. pennaefrondeum (C. Muell.) Card. = POROTRICHUM MADAGASSUM
100 P. STIPITATUM (MITT.) TOUW EX DE SLOOVER
(=P. hildebrandtii (C. Muell.) Fleisch.) 1

1762 –POROTRICHUM (BRID.) HAMPE
1. MAGILL. MS. FSA.
100 P. ELONGATUM (WELW. & DUB.) GEPP
(=Porothamnium comorense (C. Muell.) Sim) 1
200 P. MADAGASSUM KIAER EX BESCH.
(=Porothamnium pennaefrondeum (C. Muell.) Card.) 1
300 P. MOLLICULUM BROTH.
(=Porothamnium natalense (C. Muell.) Fleisch.) 1

HOOKERIACEAE (65) 1781

1781 –CALLICOSTELLA (C. MUELL.) MITT.
1. MAGILL. MS. FSA.
C. applanata Broth. & Bryhn = C. TRISTIS
100 C. TRISTIS (C.MUELL.) BROTH.
(=C. applanata Broth. & Bryhn) 1
(=Schizomitrium triste (C. Muell.) Ochyra) 1

1785 –DISTICHOPHYLLUM DOZ. & MOLK.
2. MAGILL. MS. FSA.
200 D. MNIIFOLIUM (HORNSCH.) SIM VAR. MNIIFOLIUM
(=Leskeodon mniifolius (Hornsch.) Bizot.) 2

1789 –LESKEODON BROTH. Southern African species moved to DISTICHOPHYLLUM
L. mniifolius (Hornsch.) Bizot. = DISTICHOPHYLLUM MNIIFOLIUM

1792 –Schizomitrium B.S.G. = CALLICOSTELLA
S. triste (C. Muell.) Ochyra = CALLICOSTELLA TRISTIS

PTERIDOPHYTA Contributed by C. Reid

PSILOTACEAE 10

10 –PSILOTUM SWARTZ
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

LYCOPODIACEAE 20

20 –LYCOPODIUM L.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

SELAGINELLACEAE 30

30 –SELAGINELLA BEAUV.
6. BURROWS. 1990. S.A. FERNS & FERN ALLIES.
250 S. GRISEA ALSTON
520 S. NIVEA ALSTON
S. njam-njamensis Hieron. (species does not occur in southern Africa—specimens referable to S. NIVEA ALSTON)

ISOETACEAE 40

40 –ISOETES L.
7. BURROWS. 1990. S.A. FERNS & FERN ALLIES.
300 I. GIESSII LAUNERT
I. perrieriana Iversen (species does not occur in southern Africa—specimens referable to I. GIESSII LAUNERT)

EQUISETACEAE 50

50 –EQUISETUM L.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

OPHIOGLOSSACEAE 60

60 –OPHIOGLOSSUM L.
6. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

MARATTIACEAE 70

70 –MARATTIA SWARTZ
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

OSMUNDACEAE 80

80 –OSMUNDA L.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

90 –TODEA WILLD.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

SCHIZAEACEAE 100

100 –ANEMIA SWARTZ
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

110 –LYGODIUM SWARTZ
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.
150 L. JAPONICUM SWARTZ *

120 –MOHRIA SWARTZ
7. BURROWS. 1990. S.A. FERNS & FERN ALLIES.
8. ROUX. 1990. S. AFR. J. BOT. 56,2: 266–270.
9. ROUX. 1990. S. AFR. J. BOT. 56,3: 399–402.
#. PRE HERBARIUM PRACTICE, FOLLOWING REID.
150 M. CAFFRORUM (L.) DESV. VAR. FERRUGINEA J.E. & S.M. BURROWS
(=M. nudiuscula J.P. Roux) 8, #
300 M. nudiuscula J.P. Roux = M. CAFFRORUM VAR. FERRUGINEA
400 M. RIGIDA J.P. ROUX
500 M. SAXATILIS J.P. ROUX

130 –SCHIZAEA J.E. SM.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

GLEICHENIACEAE 140

140 –DICRANOPTERIS BERNH.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

150 –GLEICHENIA J.E. SM.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

HYMENOPHYLLACEAE 160

160 —HYMENOPHYLLUM J.E. SM.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.
600 H. TUNBRIGENSE (L.) J.E. SM.
(Note spelling change)

170 —TRICHOMANES L.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.
240 T. INOPINATUM (PICHI SERM.) J.E. BURROWS
260 T. MELANOTRICHUM SCHLECHTD.
(=T. pyxidiferum L. var. melanotrichum (Schlechtd.) Schelpe) 5
T. pyxidiferum L. var. melanotrichum (Schlechtd.) Schelpe = T. MELANOTRICHUM

CYATHEACEAE 175

180 —CYATHEA J.E. SM.
4. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

MARSILEACEAE 190

190 —MARSILEA L.
7. BURROWS. 1990. S.A. FERNS & FERN ALLIES.
1050 M. NUBICA A. BR. VAR. NUBICA

AZOLLACEAE 200

200 —AZOLLA LAM.
6. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

SALVINIACEAE 210

210 —SALVINIA ADANS.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

DENNSTAEDTIACEAE 220

220 —BLOTIELLA A.F. TRYON
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

230 —HISTIOPTERIS (AGARDH) J. SM.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

240 —HYPOLEPIS BERNH.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

250 —MICROLEPIA PRESL
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

260 —PTERIDIUM SCOP.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

VITTARIACEAE 270

270 —VITTARIA J.E. SM.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

ADIANTACEAE 280

280 —ACROSTICHUM L.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

290 —ACTINIOPTERIS LINK
6. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

300 —ADIANTUM L.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.
A. phillipense L. (species does not occur in southern Africa)

310 —ANOGRAMMA LINK
6. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

330 —CERATOPTERIS BRONGN.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.
50 C. CORNUTA (BEAUV.) LE PRIEUR
(=C. thalictroides sensu Schelpe & Anthony) 5
C. thalictroides (L.) Brongn. (species does not occur in southern Africa)
C. thalictroides sensu Schelpe & Anthony = C. CORNUTA

340 —CHEILANTHES SWARTZ
8. JACOBSEN & JACOBSEN. 1988. BOTHALIA 18,1: 57–77.
9. BURROWS. 1990. S.A. FERNS & FERN ALLIES.
C. concolor (Langsd. & Fisch.) R. & A.F. Tryon = DORYOPTERIS CONCOLOR
770 C. HIRTA SWARTZ VAR. BREVIPILOSA W. & N. JACOBSEN
800 C. HIRTA SWARTZ VAR. HIRTA
810 C. HIRTA SWARTZ VAR. HYALOGLANDULOSA (W. & N. JACOBSEN) J.E. BURROWS
(=C. hyaloglandulosa W. & N. Jacobsen) 8,9
820 C. HIRTA SWARTZ VAR. INFERACAMPESTRIS W. & N. JACOBSEN
830 C. HIRTA SWARTZ VAR. NEMOROSA W. & N. JACOBSEN
C. hyaloglandulosa W. & N. Jacobsen = C. HIRTA VAR. HYALOGLANDULOSA
1370 C. NIELSII JACOBSEN

350 —DORYOPTERIS J. SM.
1. SCHELPE & ANTHONY. 1986. FSA.
3. BURROWS. 1990. S.A. FERNS & FERN ALLIES.
4. BURROWS & STRAUSS. 1990. BOTHALIA 20,2: 221–222.
100 D. CONCOLOR (LANGSD. & FISCH.) KUHN
(=Cheilanthes concolor (Langsd. & Fisch.) R. & A.F. Tryon) 1,3
200 D. PILOSA (POIR.) KUHN VAR. GEMMIFERA J.E. BURROWS & STRAUSS

360 —PELLAEA LINK
6. BURROWS. 1990. S.A. FERNS & FERN ALLIES.
200 P. CALOMELANOS (SWARTZ) LINK VAR. CALOMELANOS
250 P. CALOMELANOS (SWARTZ) LINK VAR. LEUCOMELAS (METT. EX KUHN) J.E. BURROWS
(=P. leucomelas (Mett. ex Kuhn) Bak.) 5
P. leucomelas (Mett. ex Kuhn) Bak. = P. CALOMELANOS VAR. LEUCOMELAS

370 —PITYROGRAMMA LINK
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

380 —PTERIS L.
6. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

LINDSAEACEAE 390

390 —LINDSAEA DRYAND. APUD J.E. SM.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

GRAMMITIDACEAE 395

395 —GRAMMITIS SWARTZ
6. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

POLYPODIACEAE 410

410 —LOXOGRAMME PRESL
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

420 —MICROGRAMMA PRESL
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

430 —MICROSORIUM LINK
7. BURROWS. 1990. S.A. FERNS & FERN ALLIES.
250 M. SCANDENS (FORST. F.) TINDALE *

435 —PHLEBODIUM J. SM.
3. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

450 —PLEOPELTIS H.B.K. EX WILLD.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

455 —X PLEOPODIUM SCHELPE & N.C. ANTHONY
3. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

460 —POLYPODIUM L.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

470 —PYRROSIA MIRB.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

DAVALLIACEAE 480

480 —ARTHROPTERIS J. SM.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

490 —DAVALLIA J.E. SM.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

500 —NEPHROLEPIS SCHOTT
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

510 —OLEANDRA CAV.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

ASPLENIACEAE 520

520 —ASPLENIUM L.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

530 —CETERACH DC.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

THELYPTERIDACEAE 531

532 —THELYPTERIS SCHMIDEL
10. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

535 —AMPELOPTERIS KUNZE
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

537 —MACROTHELYPTERIS (H. ITO) CHING
3. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

ATHYRIACEAE 540

540 —ATHYRIUM ROTH
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

550 —CYSTOPTERIS BERNH.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

560 —DIPLAZIUM SWARTZ
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

565 —Dryoathyrium Ching
3. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

567 —LUNATHYRIUM KEIDSUMI
3. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

LOMARIOPSIDACEAE 570

570 —BOLBITIS SCHOTT
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

580 —ELAPHOGLOSSUM SCHOTT
4. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

ASPIDIACEAE 590

590 —ARACHNIODES BLUME
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

600 —CTENITIS C. CHR. EX TARDIEU
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

605 —CYRTOMIUM PRESL
3. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

610 —DIDYMOCHLAENA DESV.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

620 —DRYOPTERIS ADANS.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

630 —HYPODEMATIUM KUNZE
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

650 —POLYSTICHUM ROTH
8. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

660 —RUMOHRA RADDI
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

670 —TECTARIA CAV.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

680 —WOODSIA R. BR.
6. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

BLECHNACEAE 690

690 —BLECHNUM L.
7. BURROWS. 1990. S.A. FERNS & FERN ALLIES.
50 B. ATTENUATUM (SWARTZ) METT. VAR. ATTENUATUM
100 B. ATTENUATUM (SWARTZ) METT. VAR. GIGANTEUM (KAULF.) BONAP.
(=B. giganteum (Kaulf.) Schlechtd.) 7
B. giganteum (Kaulf.) Schlechtd. = B. ATTENUATUM VAR. GIGANTEUM

695 —DOODIA R. BR.
1. BURROWS. 1990. S.A. FERNS & FERN ALLIES.
100 D. CAUDATA (CAV.) R. BR. *

700 —STENOCHLAENA J. SM.
5. BURROWS. 1990. S.A. FERNS & FERN ALLIES.

GYMNOSPERMAE Contributed by C. Reid

ZAMIACEAE 3000

0005000 —ENCEPHALARTOS LEHM.
7. ROBBERTSE ET AL. 1989. S. AFR. J. BOT. 55,1: 122—126.
8. LAVRANOS & GOODE. 1989. DURBAN MUS. NOVIT. 14,8: 153—156.
9. VORSTER. 1990. S. AFR. J. BOT. 56,2: 239—243.
50 E. AEMULANS P.J. VORSTER.
350 E. CERINUS LAVRANOS & GOODE
650 E. EUGENE-MARAISII VERDOORN SUBSP. MIDDELBURGENSIS LAVRANOS & GOODE
(=E. middelburgensis P.J. Vorster et al.) 7, #
E. middelburgensis P.J. Vorster et al. = E. EUGENE-MARAISII SUBSP. MIDDELBURGENSIS

ANGIOSPERMAE

MONOCOTYLEDONAE Contributed by C. Reid

CYPERACEAE 452000

0452000 —LIPOCARPHA R. BR.
3. RAYNAL. 1976. ADANSONIA SER. 2, 16: 219—224.
4. RAYNAL. 1977. ADANSONIA SER. 2, 17: 49—57.
5. GOETGHEBEUR & V.D. BORREN. 1989. AGRIC. UNIV. WAGENINGEN PAPERS 89,1.
160 L. HEMISPHAERICA (ROTH) GOETGHEBEUR
(=Hemicarpha isolepis Nees) 3
(=L. isolepis (Nees) R. Haines) 5
L. isolepis (Nees) R. Haines = L. HEMISPHAERICA
165 L. MICRANTHA (VAHL) TUCKER
(=Hemicarpha micrantha (Vahl) Pax) 3
250 L. REHMANNII (RIDLEY) GOETGHEBEUR
(=Rikliella rehmannii (Ridley) J. Raynal) 3
(=Scirpus hystrix Thunb., p.p.) 3,5
(=Scirpus hystricoides B. Nord.) 4,5

0453000 —Hemicarpha Nees & Arn. = LIPOCARPHA
H. isolepis Nees = LIPOCARPHA HEMISPHAERICA
H. micrantha (Vahl) Pax = LIPOCARPHA MICRANTHA

0454010 —Rikliella J. Raynal = LIPOCARPHA
R. rehmannii (Ridley) J. Raynal = LIPOCARPHA REHMANNII

0459000 —CYPERUS L.
6280 C. ROTUNDUS L. SUBSP. ROTUNDUS VAR. PLATYSTACHYS BOJ. EX C.B. CL.

0459030 —MARISCUS GAERTN. Revision: P.J. Vorster (STE-U).
220 M. ARISTATUS (ROTTB.) CHERM. VAR. ATRICEPS (KUEKENTH.) PODLECH
(Note change in species number)

0468000 —SCIRPUS L.
S. hystricoides B. Nord. = LIPOCARPHA REHMANNII
S. hystrix Thunb., p.p. = LIPOCARPHA REHMANNII

0469010 —ELEOCHARIS R. BR.
#. PRE HERBARIUM PRACTICE, FOLLOWING BRUHL.
1350 E. RETROFLEXA (POIR.) URB. SUBSP. SUBTILISSIMA (NELMES) K. LYE

0525000 —CAREX L. Revision: C. Reid (PRE).
6. NELMES. 1954. MEM. N.Y. BOT. GARD. 9,1: 100.
#. PRE HERBARIUM PRACTICE, FOLLOWING REID.
2050 C. SPICATO-PANICULATA C.B. CL. X C. ZULUENSIS C.B. CL.
2150 C. SYLVATICA HUDS.

LEMNACEAE 794000

0794000 —SPIRODELA SCHLEID.
3. LANDOLT. 1986. MONOGRAPH. VEROFF. GEOBOT. INST. ETH. 71.

0795000 —LEMNA L.
3. LANDOLT. 1986. MONOGRAPH. VEROFF. GEOBOT. INST. ETH. 71.

0796000 —WOLFFIA HORKEL EX SCHLEID.
3. LANDOLT. 1986. MONOGRAPH. VEROFF. GEOBOT. INST. ETH. 71.

0796010 —WOLFFIELLA HEGELM.
3. LANDOLT. 1986. MONOGRAPH. VEROFF. GEOBOT. INST. ETH. 71.
150 W. HYALINA (DEL.) MONOD
(Note change in species number)

RESTIONACEAE 804000

0804030 —ISCHYROLEPIS STEUD.
2. LINDER. 1990. S. AFR. J. BOT. 56,4: 450—457.
3650 I. SAXATILIS LINDER

0804100 —CALOPSIS BEAUV. EX. DESV.
2. LINDER. 1990. S. AFR. J. BOT. 56,4: 450—457.
2300 C. SPARSA ESTERHUYSEN

0804110 —THAMNOCHORTUS BERG.
6. LINDER. 1990. S. AFR. J. BOT. 56,4: 450—457.
150 T. AMOENA LINDER
1350 T. KAROOICA LINDER

0804140 —CANNOMOIS DESV.
3. LINDER. 1990. S. AFR. J. BOT. 56,4: 450—457.
550 C. TAYLORII LINDER

0804170 —ANTHOCHORTUS NEES
3. LINDER. 1990. S. AFR. J. BOT. 56,4: 450—457.
700 A. SINGULARIS ESTERHUYSEN

LILIACEAE 942000

0964000 —LITTONIA HOOK.
2. BREDELL. 1936. KEW BULL. 495.
#. PRE HERBARIUM PRACTICE, FOLLOWING REID.
200 L. RIGIDIFOLIA BRED.

0969000 —ANDROCYMBIUM WILLD. Revision: U. & D. Muller-Doblies (Herb. M-D).
3. MULLER-DOBLIES & MULLER-DOBLIES. 1990. WILLDENOWIA 19: 453–470.
#. PRE HERBARIUM PRACTICE, FOLLOWING OBERMEYER.
A. circinatum Bak. = A. VOLUTARE
A. decipiens N.E. Br. = A. LONGIPES
1200 A. EXIGUUM ROESSL. SUBSP. EXIGUUM
1220 A. EXIGUUM ROESSL. SUBSP. VOGELII (U. & D. MULLER-DOBLIES) U. & D. MULLER-DOBLIES
(=A. vogelii U. & D. Muller-Doblies) 3
1700 A. LONGIPES BAK.
(=A. decipiens N.E. Br.) #
(=A. natalense Bak.) #
A. natalense Bak. = A. LONGIPES
A. vogelii U. & D. Muller-Doblies = A. EXIGUUM SUBSP. VOGELII
2500 A. VOLUTARE BURCH.
(=A. circinatum Bak.) #

0985010 —TRACHYANDRA KUNTH
4. PERRY. 1990. S. AFR. J. BOT. 56,2: 257–260.
4450 T. PROLIFERA P.L. PERRY

0990000 —CHLOROPHYTUM KER-GAWL.
#. PRE HERBARIUM PRACTICE, FOLLOWING OBERMEYER.
C. pulchellum Kunth = C. RIGIDUM
1500 C. RIGIDUM KUNTH
(=C. pulchellum Kunth) #

1011000 —BOWIEA HARV. EX HOOK. F.
3. BRUYNS & VOSA. 1987. CARYOLOGIA 40,4: 287–297.
4. REID, MULLER-DOBLIES & MULLER-DOBLIES. 1990. FLOWER. PL. AFR. 51,1: T. 2007.
50 B. GARIEPENSIS V. JAARSVELD
(=B. volubilis Harv. ex Hook. f. subsp. gariepensis (V. Jaarsveld) Bruyns) 3,4
B. volubilis Harv. ex Hook. f. subsp. gariepensis (V. Jaarsveld) Bruyns = B. GARIEPENSIS

1012000 —ERIOSPERMUM JACQ. EX WILLD.
1350 E. CAPENSE (L.) THUNB.
(Note change in species number)
3620 E. MACRUM SCHLTR. EX V. POELLN.
(Note change in species number)

1026000 —ALOE L. Revision: H.F. Glen & D.S. Hardy (PRE).
12. SMITH. 1990. BOTHALIA 20,1: 80–82.
1400 A. BOWIEA SCHULT. & J.H. SCHULT.
(Note author correction)
10900 A. MYRIACANTHA (HAW.) SCHULT. & J.H. SCHULT.
(Note author correction)

1027000 —GASTERIA DUVAL Revision: E. van Jaarsveld (NBG).
3. VAN JAARSVELD. 1990. FLOWER. PL. AFR. 51,1: T. 2014.
4800 G. PILLANSII KENSIT

1047000 —TULBAGHIA L.
5. VOSA. 1982. JL S. AFR. BOT. 48: 241–244.
150 T. X ALICEAE VOSA
1520 T. LUEBBERTIANA ENGL. & KRAUSE

1089000 —ORNITHOGALUM L.
3. HILLIARD & BURTT. 1989. NOTES R. BOT. GDN EDINB. 45,2: 195.
4. HILLIARD & BURTT. 1990. NOTES R. BOT. GDN EDINB. 46,3: 343.
300 O. BAURII BAK.
(=O. hygrophilum Hilliard & Burtt) 3,4
O. hygrophilum Hilliard & Burtt = O. BAURII

1090000 —DRIMIOPSIS LINDL. Revision: U. & D. Muller-Doblies (Herb. M-D).
2. JESSOP. 1972. JL S. AFR. BOT. 38: 151–162.
300 D. LACHENALIOIDES (BAK.) JESSOP
(=Resnova lachenalioides (Bak.) V.d. Merwe) 2
500 D. MAXIMA BAK.
(=Resnova maxima (Bak.) V.d. Merwe) 2
(=Resnova minor V.d. Merwe) 2
(=Resnova pilosa V.d. Merwe) 2
(=Resnova schlechteri (Bak.) V.d. Merwe) 2
(=Resnova transvaalensis V.d. Merwe) 2

1090005 —Resnova V.d. Merwe = DRIMIOPSIS
R. lachenalioides (Bak.) V.d. Merwe = DRIMIOPSIS LACHENALIOIDES
R. maxima (Bak.) V.d. Merwe = DRIMIOPSIS MAXIMA
R. minor V.d. Merwe = DRIMIOPSIS MAXIMA
R. pilosa V.d. Merwe = DRIMIOPSIS MAXIMA
R. schlechteri (Bak.) V.d. Merwe = DRIMIOPSIS MAXIMA
R. transvaalensis V.d. Merwe = DRIMIOPSIS MAXIMA

1093000 —Hyacinthus L. Southern African species moved to POLYXENA
H. paucifolius W.F. Barker = POLYXENA PAUCIFOLIA

1098000 —LACHENALIA JACQ. F. EX MURRAY
26. BARKER. 1989. S. AFR. J. BOT. 55,6: 630–646.
#. PRE HERBARIUM PRACTICE, FOLLOWING BARKER.
550 L. BOWKERI BAK.
(=L. subspicata Fourc.) #
3070 L. ORCHIOIDES (L.) AIT. VAR. GLAUCINA (JACQ.) W.F. BARKER
(Note change in species number)
3500 L. PATULA JACQ.
(=L. succulenta Masson ex Bak.) 26
L. subspicata Fourc. = L. BOWKERI
L. succulenta Masson ex Bak. = L. PATULA

1099000 —POLYXENA KUNTH
#. PRE HERBARIUM PRACTICE, FOLLOWING MULLER-DOBLIES.
200 P. ENSIFOLIA (L. F.) SCHOENL.
(Note change of author)
300 P. MAUGHANII W.F. BARKER
450 P. PAUCIFOLIA W.F. BARKER
(=Hyacinthus paucifolius W.F. Barker) #
500 P. PYGMAEA (JACQ.) KUNTH

AMARYLLIDACEAE 1166000

1167010 —SCADOXUS RAF.
150 S. MULTIFLORUS (MARTYN) RAF. SUBSP. KATHARINAE (BAK.) FRIIS & NORDAL
(Note change in species number)

1175000 —NERINE HERB.
100 N. ANGUSTIFOLIA (BAK.) BAK.
(Note author correction)

1189000 —CRINUM L.
1. VERDOORN. 1973. REVISION. BOTHALIA 11: 27–52.
200 C. BAUMII HARMS
(=Ammocharis baumii (Harms) Milne-Redh. & Schweick.) 1

1190000 —AMMOCHARIS HERB.
A. baumii (Harms) Milne-Redh. & Schweick. = CRINUM BAUMII
150 A. HERREI LEIGHTON
(Note change in species number)

1191000 —CYRTANTHUS L. F.
6. TRAUB. 1972. PLANT LIFE 28: 66.
9. HILLIARD & BURTT. 1986. NOTES R. BOT. GARD. EDINB. 43: 189–191.
C. capensis Traub = C. SPECIOSUS

4100 C. SPECIOSUS R.A. DYER
(=C. capensis Traub) 6,9

HYPOXIDACEAE 1229010

1230000 –HYPOXIS L.
3000 H. MULTICEPS BUCHINGER EX BAK.
(Note author correction)

TECOPHILAEACEAE 1231000

1233000 –CYANELLA L. Revision: G. Scott (NBG).
3. SCOTT. 1991. S. AFR. J. BOT. 57,1: 34–54.
240 C. AQUATICA OBERM. EX G. SCOTT
260 C. CYGNEA G. SCOTT
300 C. HYACINTHOIDES L.
(=C. pentheri Zahlbr.) 3
C. krauseana Dinter & Schulze = C. RAMOSISSIMA
C. lutea L. f. var. angustifolia Schinz = C. LUTEA
500 C. LUTEA L. F.
(=C. lutea L. f. var. angustifolia Schinz) 3
(=C. lutea L. f. var. rosea Bak.) 3
C. lutea L. f. var. rosea Bak. = C. LUTEA
C. racemosa Schinz = C. LUTEA
900 C. RAMOSISSIMA (ENGL. & KRAUSE) ENGL. & KRAUSE
(=C. krauseana Dinter & Schulze) 3

VELLOZIACEAE 1246000

1247010 –XEROPHYTA JUSS.
650 X. SUAVEOLENS (GREVES) N. MENEZES
(Note change in species number)

IRIDACEAE 1259000

1272000 –FERRARIA BURM. EX MILL.
950 F. UNCINATA SWEET SUBSP. MACROCHLAMYS (BAK.) DE VOS
(Note change in species number)

1295000 –ARISTEA AIT.
1000 A. COMPRESSA BUCHINGER EX BAK.
(Note author correction)
3700 A. SCHIZOLAENA HARV. EX BAK.
(Note author correction)

1303000 –DIERAMA K. KOCH Revision: O.M. Hilliard (E).
3. HILLIARD & BURTT. 1991. THE HAIRBELLS OF AFRICA.
100 D. ARGYREUM L. BOL.
(=D. argyreum L. Bol. var. majus N.E. Br.) 3
D. argyreum L. Bol. var. majus N.E. Br. = D. ARGYREUM
D. longiflorum G.J. Lewis = D. PULCHERRIMUM
1570 D. NIXONIANUM HILLIARD
1580 D. PALLIDUM HILLIARD
1900 D. PENDULUM (L. F.) BAK.
(Note author correction)
2100 D. PULCHERRIMUM (HOOK. F.) BAK.
(=D. longiflorum G.J. Lewis) 3
2550 D. SERTUM HILLIARD

1306030 –CHASMANTHE N.E. BR.
C. caffra (Bak.) N.E. Br. = TRITONIOPSIS CAFFRA
C. intermedia (Bak.) N.E. Br. = TRITONIOPSIS INTERMEDIA
C. spectabilis (Schinz) N.E. Br. = GLADIOLUS MAGNIFICUS

1306070 –Petamenes Salisb. = CHASMANTHE, GLADIOLUS, TRITONIOPSIS
P. abbreviatus (Andr.) N.E. Br. = GLADIOLUS ABBREVIATUS
P. caffra (Bak.) Phill. = TRITONIOPSIS CAFFRA
P. cunonia (L.) Phill. = GLADIOLUS CUNONIUS
P. intermedia (Bak.) Phill. = TRITONIOPSIS INTERMEDIA
P. saccatus (Klatt) Phill. = GLADIOLUS SACCATUS SUBSP. SACCATUS
P. spectabilis (Schinz) Phill. = GLADIOLUS MAGNIFICUS
P. splendens (Sweet) Phill. = GLADIOLUS SPLENDENS
P. steingroeveri (Pax) Phill. = GLADIOLUS SACCATUS SUBSP. STEINGROEVERI

1306090 –DEVIA GOLDBL. & MANNING
1. GOLDBLATT & MANNING. 1990. ANN. MISSOURI BOT. GARD. 77,2: 359–364.
100 D. XEROMORPHA GOLDBL. & MANNING

1310000 –BABIANA KER-GAWL.
5. GOLDBLATT. 1990. S. AFR. J. BOT. 56,5: 577–582.
5050 B. RINGENS (L.) KER-GAWL., KONIG & SIMS
(=Antholyza ringens L.) 5
7150 B. THUNBERGII KER-GAWL., KONIG & SIMS
(=Anaclanthe namaquensis N.E. Br.) 5
(=Anaclanthe plicata (L. f.) N.E. Br.) 5
(=Antholyza plicata L. f.) 5

1311000 –GLADIOLUS L.
12. GOLDBLATT & DE VOS. 1989. BULL. MUS. NATN. HIST. NAT., PARIS, 4E SER., 11, SECT. B., ADANSONIA 11,4: 417–428.
#. PRE HERBARIUM PRACTICE, FOLLOWING REID.
50 G. ABBREVIATUS ANDR.
(=Homoglossum abbreviatum (Andr.) Goldbl.) 12
(=Petamenes abbreviatus (Andr.) N.E. Br.) #
1460 G. BONAESPEI GOLDBL. & DE VOS
(=Homoglossum merianellum (Thunb.) Bak. var. aureum G.J. Lewis) #
(=Homoglossum merianellum (Thunb.) Bak. var. merianellum) 12
3450 G. CUNONIUS (L.) GAERTN.
(=Anomalesia cunonia (L.) N.E. Br.) #
(=Petamenes cunonia (L.) Phill.) #
5350 G. FOURCADEI (L. BOL.) GOLDBL & DE VOS
(=Homoglossum fourcadei (L. Bol.) N.E. Br.) #
5850 G. HUTTONII (N.E. BR.) GOLDBL. & DE VOS
(=Homoglossum hollandii L.Bol.var.hollandii) #
(=Homoglossum hollandii L. Bol. var. zitzikamense L. Bol.) #
(=Homoglossum huttonii N.E. Br.) 12
7650 G. MAGNIFICUS (HARMS.) GOLDBL.
(=Chasmanthe spectabilis (Schinz) N.E. Br.) #
(=Oenostachys zambesiacus (Bak.) Goldbl.) 12
(=Petamenes spectabilis (Schinz) Phill.) #
9350 G. OVERBERGENSIS GOLDBL. & DE VOS
(=Homoglossum guthriei (L. Bol.) L. Bol.) #
10250 G. PRIORII (N.E. BR.) GOLDBL. & DE VOS
(=Homoglossum priorii (N.E. Br.) N.E. Br.) #
10650 G. QUADRANGULARIS (BURM. F.) AIT.
(=Homoglossum quadrangulare (Burm. f.) N.E. Br.) 12
11240 G. SACCATUS (KLATT) GOLDBL. & DE VOS SUBSP. SACCATUS
(=Anomalesia saccata (Klatt) Goldbl.) 12
(=Kentrosiphon saccatus (Klatt) N.E. Br.) #
(=Petamenes saccatus (Klatt) Phill.) #
11260 G. SACCATUS (KLATT) GOLDBL. & DE VOS SUBSP. STEINGROEVERI (PAX) GOLDBL. & DE VOS
(=Anomalesia saccata (Klatt) Goldbl. subsp. steingroeveri (Pax) Oberm. comb. nov. ined.) #
(=Kentrosiphon saccatus (Klatt) N.E. Br. subsp. steingroeveri (Pax) Oberm.) 12
(=Kentrosiphon steingroeveri (Pax) N.E. Br.) #
(=Petamenes steingroeveri (Pax) Phill.) #
11850 G. SPLENDENS (SWEET) HERB.
(=Anomalesia splendens (Sweet) N.E. Br.) 12
(=Petamenes splendens (Sweet) Phill.) #
12450 G. TERETIFOLIUS GOLDBL. & DE VOS
(=Homoglossum muirii (L. Bol.) L. Bol.) #
13150 G. VANDERMERWEI (L. BOL.) GOLDBL. & DE VOS

(=Homoglossum vandermerwei (L. Bol.) L. Bol.) #
14070 G. WATSONIUS THUNB. VAR. MACULOSUS DE VOS & GOLDBL.
14090 G. WATSONIUS THUNB. VAR. WATSONIUS
(=Homoglossum watsonium (Thunb.) N.E. Br.) 12

1311010 —Homoglossum Salisb. = GLADIOLUS
H. abbreviatum (Andr.) Goldbl. = GLADIOLUS ABBREVIATUS
H. fourcadei (L. Bol.) N.E. Br. = GALDIOLUS FOURCADEI
H. guthriei (L. Bol.) L. Bol. = GLADIOLUS OVERBERGENSIS
H. hollandii L. Bol. var. hollandii = GLADIOLUS HUTTONII
H. hollandii L. Bol. var. zitzikamense L. Bol. = GLADIOLUS HUTTONII
H. huttonii N.E. Br. = GLADIOLUS HUTTONII
H. merianellum (Thunb.) Bak. var. aureum G.J. Lewis = GLADIOLUS BONAESPEI
H. merianellum (Thunb.) Bak. var. merianellum = GLADIOLUS BONAESPEI
H. muirii (L. Bol.) N.E. Br. = GLADIOLUS TERETIFOLIUS
H. priorii (N.E. Br.) N.E. Br. = GLADIOLUS PRIORII
H. quadrangulare (Burm. f.) N.E. Br. = GLADIOLUS QUADRANGULARIS
H. vandermerwei (L. Bol.) L. Bol. = GLADIOLUS VANDERMERWEI
H. watsonium (Thunb.) N.E. Br. = GLADIOLUS WATSONIUS VAR. WATSONIUS

1311020 —Anomalesia N.E. Br. = GLADIOLUS
A. cunonia (L.) N.E. Br. = GLADIOLUS CUNONIUS
A. saccata (Klatt) Goldbl. = GLADIOLUS SACCATUS SUBSP. SACCATUS
A. saccata (Klatt) Goldbl. subsp. steingroeveri (Pax) Oberm. comb. ined. = GLADIOLUS SACCATUS SUBSP. STEINGROEVERI
A. splendens (Sweet) N.E. Br. = GLADIOLUS SPLENDENS

1311030 —Oenostachys Bullock = GLADIOLUS
O. zambesiacus (Bak.) Goldbl. = GLADIOLUS MAGNIFICUS

1311050 —Kentrosiphon N.E. Br. = GLADIOLUS
K. saccatus (Klatt) N.E. Br. = GLADIOLUS SACCATUS SUBSP. SACCATUS
K. saccatus (Klatt) N.E. Br. subsp. steingroeveri (Pax) Oberm. = GLADIOLUS SACCATUS SUBSP. STEINGROEVERI
K. steingroeveri (Pax) N.E. Br. = GLADIOLUS SACCATUS SUBSP. STEINGROEVERI

1312000 —Antholyza L. = BABIANA, CHASMANTHE, TRITONIOPSIS
A. lucidor Bak. = TRITONIOPSIS TRITICEA
A. plicata L. f. = BABIANA THUNBERGII
A. ringens L. = BABIANA RINGENS

1312010 —TRITONIOPSIS L. BOL.
2. GOLDBLATT. 1990. S. AFR. J. BOT. 56,5: 577—582.
#. PRE HERBARIUM PRACTICE, FOLLOWING REID.
240 T. BURCHELLII (N.E. BR.) GOLDBL.
(=Anapalina burchellii (N.E. Br.) N.E. Br.) #
260 T. CAFFRA (KER-GAWL. EX BAK.) GOLDBL.
(=Anapalina caffra (Ker-Gawl. ex Bak.) G.J. Lewis) #
(=Chasmanthe caffra (Bak.) N.E. Br.) #
(=Petamenes caffra (Bak.) Phill.) #
650 T. INTERMEDIA (BAK.) GOLDBL.
(=Anapalina intermedia (Bak.) G.J. Lewis) #
(=Chasmanthe intermedia (Bak.) N.E. Br.) #
(=Petamenes intermedia (Bak.) Phill.) #
1050 T. LONGITUBA (FOURC.) GOLDBL.
(=Anapalina longituba Fourc.) 2
1200 T. NERVOSA (BAK.) G.J. LEWIS
(Note: T. nervosa (Thunb.) Goldbl. is an invalid combination.)
1650 T. PULCHRA (BAK.) GOLDBL.
(=Anapalina pulchra (Bak.) N.E. Br.) #
1950 T. TRITICEA (BURM. F.) GOLDBL.
(=Anapalina triticea (Burm. f.) N.E. Br.) #
(=Antholyza lucidor Bak.) #
2100 T. WILLIAMSIANA GOLDBL.

1312020 —Anapalina N.E. Br. = TRITONIOPSIS
(All species to be transferred to TRITONIOPSIS, but not all combinations validly published.)
A. burchellii (N.E. Br.) N.E. Br. = TRITONIOPSIS BURCHELLII
A. caffra (Ker-Gawl. ex Bak.) G.J. Lewis = TRITONIOPSIS CAFFRA
A. intermedia (Bak.) G.J. Lewis = TRITONIOPSIS INTERMEDIA
A. longituba Fourc. = TRITONIOPSIS LONGITUBA
500 A. NERVOSA (THUNB.) G.J. LEWIS
A. pulchra (Bak.) N.E. Br. = TRITONIOPSIS PULCHRA
A. triticea (Burm. f.) N.E. Br. = TRITONIOPSIS TRITICEA

1312030 —Anaclanthe N.E. Br. = BABIANA
A. namaquensis N.E. Br. = BABIANA THUNBERGII
A. plicata (L. f.) N.E. Br. = BABIANA THUNBERGII

1313010 —THEREIANTHUS G.J. LEWIS
2. GOLDBLATT. 1989. ANN. KIRSTENB. BOT. GARD. 19: 143.
#. PRE HERBARIUM PRACTICE, FOLLOWING REID.
T. lapeyrousioides (Bak.) G.J. Lewis var. elatior G.J. Lewis = T. MINUTUS
T. lapeyrousioides (Bak.) G.J. Lewis var. lapeyrousioides = T. MINUTUS
550 T. MINUTUS (KLATT) G.J. LEWIS
(=T. lapeyrousioides (Bak.) G.J. Lewis var. elatior G.J. Lewis) #
(=T. lapeyrousioides (Bak.) G.J. Lewis var. lapeyrousioides) 2

1314000 —LAPEIROUSIA POURRET
4. GOLDBLATT. 1990. ANN. MISSOURI BOT. GARD. 77: 430—484.
L. caudata Schinz subsp. burchellii (Bak.) Marais & Goldbl. = L. LITTORALIS SUBSP. LITTORALIS
L. caudata Schinz subsp. caudata = L. LITTORALIS SUBSP. CAUDATA
L. cyanescens Bak. = L. SCHIMPERI
2020 L. LITTORALIS BAK. SUBSP. CAUDATA (SCHINZ) GOLDBLATT
(=L. caudata Schinz subsp. caudata) 4
2040 L. LITTORALIS BAK. SUBSP. LITTORALIS
(=L. caudata Schinz subsp. burchellii (Bak.) Marais & Goldblatt) 4
(=L. ramosissima Dinter) 4
2060 L. MASUKUENSIS VAUPEL & SCHLTR.
L. ramosissima Dinter = L. LITTORALIS SUBSP. LITTORALIS
3000 L. SCHIMPERI (ASCHERS. & KLATT) MILNE-REDH.
(=L. cyanescens Bak.) 4

ZINGIBERACEAE 1324000

1346000 —KAEMPFERIA L. Revision: R.M. Smith (E).
K. montagui Leighton = SIPHONOCHILUS KIRKII
K. rosea Schweinf. ex Bak. = SIPHONOCHILUS KIRKII

1346010 —SIPHONOCHILUS WOOD & FRANKS Revision: R.M. Smith (E).
4. LOCK. 1985. FTEA.
#. PRE HERBARIUM PRACTICE, FOLLOWING OBERMEYER.

150 S. KIRKII (HOOK. F.) BAK.
(=Kaempferia montagui Leighton) #
(=Kaempferia rosea Schweinf. ex Bak.) 4

ORCHIDACEAE 1389000

1408000 —HOLOTHRIX L.C. RICH. EX HOOK. Revision: K. Immelman (PRE).
2550 H. VILLOSA LINDL. VAR. CONDENSATA (SOND.) IMMELMAN
(Note change in species number)

1434000 —DISA BERG.
10. LINDER. 1986. BOTHALIA 16: 56–57.
750 D. CEPHALOTES REICHB. F. SUBSP. FRIGIDA (SCHLTR.) LINDER
(Note change in species number)
2270 D. GLANDULOSA BURCH. EX LINDL.
(Note change in species number)
2700 D. LONGICORNU L. F.
(Note new spelling)
6450 D. TRIPETALOIDES (L. F.) N.E. BR. SUBSP. AURATA (H. BOL.) LINDER
(Note change in species number)
7000 D. VASSELOTII H. BOL. EX SCHLTR.
(Note author correction)

1436000 —MONADENIA LINDL.
2050 M. RUFESCENS (THUNB.) LINDL.
(Note author correction)

1437000 —DISPERIS SWARTZ
2. MANNING. 1990. S. AFR. J. BOT. 56,4: 493–496.
600 D. BOLUSIANA SCHLTR. EX H. BOL. SUBSP. BOLUSIANA
(Note author correction)
650 D. BOLUSIANA SCHLTR. EX H. BOL. SUBSP. MACROCORYS (ROLFE) J.C. MANNING
(=D. macrocorys Rolfe) 2
750 D. CAPENSIS (L.) SWARTZ VAR. BREVICAUDATA ROLFE
(Note change in species number)
950 D. CIRCUMFLEXA (L.) DUR. & SCHINZ SUBSP. AEMULA (SCHLTR.) J.C. MANNING
(=D. circumflexa (L.) Dur. & Schinz var. aemula Schltr.) 2
1000 D. CIRCUMFLEXA (L.) DUR. & SCHINZ SUBSP. CIRCUMFLEXA
D. circumflexa (L.) Dur. & Schinz var. aemula Schltr. = D. CIRCUMFLEXA SUBSP. AEMULA
D. macrocorys Rolfe = D. BOLUSIANA SUBSP. MACROCORYS
D. stenoglossa Schltr. = D. WOODII
3500 D. WEALII REICHB. F.
(Note new spelling)
3600 D. WOODII H. BOL.
(=D. stenoglossa Schltr.) 2

1438020 —ANOCHILUS ROLFE
150 A. HALLII SCHELPE
(Note change in species number)

1561000 —ACROLOPHIA PFITZER
A. paniculata Cribb = EULOPHIA CALLICHROMA

1648000 —EULOPHIA R. BR. EX LINDL.
3. CRIBB. 1989. FTEA ORCH. 3.
250 E. ADENOGLOSSA (LINDL.) REICHB. F.
(=E. nigricans Schltr.) 3
450 E. CALLICHROMA REICHB. F.
(=Acrolophia paniculata Cribb) 3
2050 E. LIVINGSTONIANA (REICHB. F.) SUMMERH.
(Note author correction)
E. nigricans Schltr. = E. ADENOGLOSSA

1648020 —OECEOCLADES LINDL.
50 O. LONCHOPHYLLA (REICHB. F.) GARAY & TAYLOR
(Note change in species number)

1705000 —BULBOPHYLLUM THOUARS
50 B. MALAWIENSE MORRIS
(Note change in species number)

POACEAE Contributed by L. Fish 9900010

9900881 —MEGALOPROTACHNE C.E. HUBB.
3. CLAYTON. 1989. FZ 10,3: 130–133.
100 M. ALBESCENS C.E. HUBB.
(=M. glabrescens C.E. Hubb.) 3
M. glabrescens Roiv. = M. ALBESCENS

9900890 —DIGITARIA HALLER Revision: P.D.F. Kok (PRU).
5. GOETGHEBEUR & V.D. VEKEN. 1989. FZ 10,3: 133–178.
D. abyssinica (A. Rich.) Stapf (species not recorded in southern Africa; regarded as distinct from D. scalarum)
3400 D. SCALARUM (SCHWEINF.) CHIOV.
(=D. vestita Fig. & De Not. var. scalarum (Schweinf.) Henr.) 5
D. vestita Fig. & De Not. var. scalarum (Schweinf.) Henr. = D. SCALARUM

9901040 —BRACHIARIA (TRIN.) GRISEB.
5. CLAYTON. 1989. FZ 10,3.
350 B. CHUSQUEOIDES (HACK.) CLAYTON
(=Panicum obumbratum Stapf) 5

9901070 —PASPALUM L.
5. CLAYTON. 1989. FZ 10,3.
P. auriculatum Presl = P. SCROBICULATUM
550 P. SCROBICULATUM L.
(=P. auriculatum Presl) 5

9901160 —PANICUM L.
P. obumbratum Stapf = BRACHIARIA CHUSQUEOIDES

9901240 —SACCIOLEPIS NASH
3. CLAYTON. 1989. FZ 10,3.
S. huillensis (Rendle) Stapf = S. SPICIFORMIS
755 S. SPICIFORMIS (A. RICH.) STAPF
(=S. huillensis (Rendle) Stapf) 3

9901380 —ANTHEPHORA SCHREB.
2. CLAYTON. 1989. FZ 10,3.
A. angustifolia Goossens = A. ARGENTEA
200 A. ARGENTEA GOOSSENS
(=A. angustifolia Goossens) 2

9901752 —LOUDETIOPSIS CONERT
L. glabrata (K. Schum.) Conert (species does not occur in southern Africa)

9902630 —STIPA L.
4. BARKWORTH. 1990. TAXON 39,4: 597–614.
S. neesiana Trin. & Rupr. = NASSELLA NEESIANA
S. tenuissima Trin. = NASSELLA TENUISSIMA

9902650 —NASSELLA DESV.
3. BARKWORTH. 1990. TAXON 39,4: 597–614.
25 N. NEESIANA (TRIN. & RUPR.) BARKWORTH
(=Stipa neesiana Trin. & Rupr.) 3
50 N. TENUISSIMA (TRIN.) BARKWORTH
(=Stipa tenuissima Trin.) 3

9902830 —SPOROBOLUS R. BR.
5. VELDKAMP. 1990. KEW BULL. 45,3: 581.
S. artus Stent = S. SUBULATUS
S. mauritianus (Steud.) Dur. & Schinz (species does not occur in southern Africa)
S. mauritianus auct. non (Steud.) Dur. & Schinz = S. SUBULATUS
3450 S. SUBULATUS HACK.
(=S. artus Stent) 2,5
(=S. mauritianus auct. non (Steud.) Dur. & Schinz) 5

9902860 —ERAGROSTIS WOLF
11. DE WINTER. 1990. BOTHALIA 20,2: 208–209.
2050 E. COMPTONII DE WINTER (Described from Swaziland 2631 (MBABANE): hill NE of Mbabane, Compton 26766)
4000 E. LAPPULA NEES
(=E. lappula Nees var. divaricata Stapf) 9
E. lappula Nees var. divaricata Stapf = E. LAPPULA

DICOTYLEDONAE

MORACEAE Contributed by M. Jordaan 1908000

1913000 —MORUS L.
1. COATES PALGRAVE. 1977. TREES SN AFR. 100
M. lactea (Sim) Mildbr. = M. MESOZYGIA
300 M. MESOZYGIA STAPF
(=M. lactea (Sim) Mildbr.) 1

1960000 —Bosquiea Thouars ex Baill. = TRILEPISIUM
B. phoberos Baill. = TRILEPISIUM MADAGASCARIENSE

1960010 —TRILEPISIUM THOUARS
1. BERG ET AL. 1984. FL. DU GABON 26: 104–108.
100 T. MADAGASCARIENSE DC.
(=Bosquiea phoberos Baill.) 1

1961000 —FICUS L.
7. VAN GREUNING. 1990. S. AFR. J. BOT. 56,6: 599–630.
1900 F. SANSIBARICA WARB. SUBSP. SANSIBARICA
2500 F. TREMULA WARB. SUBSP. TREMULA

URTICACEAE Contributed by M. Jordaan 1974000

1974000 —URTICA L.
200 U. LOBULATA E. MEY. EX BLUME
(Note author correction)

PROTEACEAE Contributed by M. Jordaan 2016000

2030000 —SERRURIA SALISB.
2. ROURKE. 1982. JL S. AFR. BOT. 48,2: 285–293.
3. BOND & GOLDBLATT. 1984. JL S. AFR. BOT. SUPPL. 13: 375–377.
4. ROURKE. 1990. S. AFR. J. BOT. 56,4: 497–505.
200 S. ADSCENDENS (LAM.) R. BR.
S. adscendens (Lam.) R. Br. var. decipiens (R. Br.) Hutch. = S. DECIPIENS
300 S. AEMULA SALISB. EX KNIGHT
(=S. ciliata R. Br. var. ciliata) 3
S. aemula Salisb. ex Knight var. heterophylla (Meisn.) Hutch. = S. HETEROPHYLLA
500 S. AITONII R. BR.
(=S. argentifolia Phill. & Hutch.) 3
S. anethifolia Knight = S. TRITERNATA
S. argentifolia Phill. & Hutch. = S. AITONII
S. artemisiifolia Knight = S. PEDUNCULATA
S. barbigera Knight = S. PHYLICOIDES
S. biglandulosa Schltr. = S. FASCIFLORA
S. bolusii Phill. & Hutch. = S. NERVOSA
1450 S. BROWNII MEISN.
S. burmannii R. Br. = S. FASCIFLORA
S. ciliata R. Br. var. ciliata = S. AEMULA
S. ciliata R. Br. var. congesta (R. Br.) Hutch. = S. FOENICULACEA
2000 S. COLLINA SALISB. EX KNIGHT
(=S. flagellaris R. Br.) 3
2450 S. DECIPIENS R. BR.
(=S. adscendens (Lam.) R. Br. var. decipiens (R. Br.) Hutch.) 3
2475 S. DECUMBENS (THUNB.) R. BR.
(=S. hyemalis Knight) 3
2550 S. DELUVIALIS ROURKE
2750 S. EFFUSA ROURKE
2800 S. ELONGATA (BERG.) R. BR.
3100 S. FASCIFLORA SALISB. EX KNIGHT
(=S. biglandulosa Schltr.) 3
(=S. burmannii R. Br.) 3
(=S. knightii Hutch.) 3
(=S. pauciflora Phill. & Hutch.) 3
(=S. subsericea Hutch.) 3
S. flagellaris R. Br. = S. COLLINA
3400 S. FLAVA MEISN.
3500 S. FLORIDA (THUNB.) SALISB. EX KNIGHT
3600 S. FOENICULACEA R. BR.
(=S. ciliata R. Br. var. congesta (R. Br.) Hutch.) 3
4250 S. HETEROPHYLLA MEISN.
(=S. aemula Salisb. ex Knight var. heterophylla (Meisn.) Hutch.) 3
S. hyemalis Knight = S. DECUMBENS
4600 S. INCRASSATA MEISN.
S. knightii Hutch. = S. FASCIFLORA
5000 S. LINEARIS SALISB. EX KNIGHT
(=S. simplicifolia R. Br.) 3
S. longipes Phill. & Hutch. = S. PEDUNCULATA
5300 S. MILLEFOLIA SALISB. EX KNIGHT
5600 S. NERVOSA MEISN.
(=S. bolusii Phill. & Hutch.) 3
S. pauciflora Phill. & Hutch. = S. FASCIFLORA
5800 S. PEDUNCULATA (LAM.) R. BR.
(=S. artemisiifolia Knight) 3
(=S. longipes Phill. & Hutch.) 3
5850 S. PHYLICOIDES (BERG.) R. BR.
(=S. barbigera Knight) 3
5950 S. PLUMOSA MEISN.
6250 S. REFLEXA ROURKE
6275 S. ROSEA PHILL.
6300 S. ROSTELLARIS SALISB. EX KNIGHT
(Note author correction)
S. simplicifolia R. Br. = S. LINEARIS
S. subsericea Hutch. = S. FASCIFLORA
6800 S. TRILOPHA SALISB. EX KNIGHT
6850 S. TRITERNATA (THUNB.) R. BR.
(=S. anethifolia Knight) 3
S. vallaris Knight = S. VILLOSA
7020 S. VILLOSA (LAM.) R. BR.
(=S. vallaris Knight) 3
7030 S. VIRIDIFOLIA ROURKE

The following names in Fl. Cap. have not been accounted for:
S. aitonii R. Br. var. multifida Meisn.
S. anemonefolia Knight
S. bergii R. Br.
S. chlamidiflora Knight
S. colorata Buek
S. concinna Knight
S. delphiniifolia Knight
S. elumbis Knight
S. fallax Knight
S. foliosa Knight
S. frondosa Knight
S. gremiiflora Knight
S. montana Knight
S. pulchella Knight
S. quinquemestris Knight
S. rangiferina Knight
S. zanthophylla Knight

2031000 —MIMETES SALISB.
M. purpureus (L.) R. Br. = DIASTELLA PROTEOIDES

2031020 —DIASTELLA SALISB.
1. ROURKE. 1976. JL S. AFR. BOT. 42,1: 185–210.
850 D. PROTEOIDES (L.) DRUCE
(=Mimetes purpureus (L.) R. Br.) 1

2034000 —FAUREA HARV.
2. COATES PALGRAVE. 1977. TREES SN AFR. 125–127.
(=F. natalensis Phill.) 2
F. natalensis Phill. = F. MACNAUGHTONII

2037000 —LEUCADENDRON R. BR.
2. VAN WYK. 1990. S. AFR. J. BOT. 56,4: 458—466.
6050 L. PONDOENSE VAN WYK

SANTALACEAE Contributed by M. Jordaan 2096000

2104000 —COLPOON BERG.
2. BEAN. 1990. S. AFR. J. BOT. 56,6: 665—669.
200 C. SPECIOSUM (A.W. HILL) BEAN

2117000 —THESIDIUM SOND.
2. BOND & GOLDBLATT. 1984. JL S. AFR. BOT. SUPPL. 13: 405—406.
100 T. FRAGILE (THUNB.) SOND.
(Note author correction)
350 T. LEPTOSTACHYUM (A. DC.) SOND.
500 T. MICROCARPUM (A. DC.) A. DC.
(Note author correction)
650 T. PODOCARPUM (A. DC.) A. DC.
(=T. thunbergii Sond.) 2
T. thunbergii Sond. = T. PODOCARPUM

GRUBBIACEAE Contributed by M. Jordaan 2121000

2121000 —GRUBBIA BERG. Revision: S. Carlquist (POM).
425 G. ROSMARINIFOLIA BERG. SUBSP. HIRSUTA (E. MEY. EX DC.) S. CARLQUIST
(Note change in species number)
520 G. ROURKEI S. CARLQUIST
(Note change in species number)

OLACACEAE Contributed by M. Jordaan 2129000

2136000 —XIMENIA L.
2. GARCIA & VIDIGAL. 1979. FL. MOZAM. 44: 1—5.
150 X. AMERICANA L. VAR. AMERICANA
175 X. AMERICANA L. VAR. MICROPHYLLA WELW. EX OLIV.
(=X. rogersii Burtt Davy) 1
X. rogersii Burtt Davy = X. AMERICANA VAR. MICROPHYLLA

ARISTOLOCHIACEAE Contributed by M. Jordaan 2169000

2174000 —ARISTOLOCHIA L.
3. VERDCOURT. 1986. FTEA, ARISTOLOCHIACEAE 4—11.
25 A. ALBIDA DUCH.
(=A. bainesii Burtt Davy) 3
A. bainesii Burtt Davy = A. ALBIDA

POLYGONACEAE Contributed by G. Germishuizen 2184000

2194000 —EMEX NECK. (Note author correction)

2201000 —POLYGONUM L. Revision: G. Germishuizen (PRE).
P. alatum Buch.-Ham. ex Spreng. = PERSICARIA NEPALENSIS
P. amphibium L. = PERSICARIA AMPHIBIA *
P. capitatum Buch.-Ham. ex D. Don = PERSICARIA CAPITATA *
P. convolvulus L. = FALLOPIA CONVOLVULUS
P. glutinosum Meisn. var. capensis Meisn. = PERSICARIA SENEGALENSIS FORMA ALBOTOMENTOSA
P. hydropiper L. = PERSICARIA HYDROPIPER *
P. lanigerum R. Br. var. africanum Meisn. = PERSICARIA SENEGALENSIS FORMA ALBOTOMENTOSA
P. lapathifolium L. subsp. maculatum (S.F. Gray) T.-Dyer & Trim. = PERSICARIA LAPATHIFOLIA *
P. lapathifolium L. var. maculatum T.-Dyer & Trim. = PERSICARIA LAPATHIFOLIA *
P. limbatum Meisn. = PERSICARIA LIMBATA *
P. nepalense Meisn. = PERSICARIA NEPALENSIS *
P. piliferum Tikovsky = PERSICARIA LIMBATA *
P. pulchrum Blume (species does not occur in southern Africa)
P. pulchrum auct. non Blume = PERSICARIA ATTENUATA SUBSP. AFRICANA
P. salicifolium Willd. = PERSICARIA SERRULATA
P. sambesiacum Schuster = PERSICARIA SENEGALENSIS FORMA SENEGALENSIS
P. schinzii C.H. Wr. = PERSICARIA LIMBATA *
P. senegalense Meisn. subsp. albotomentosum (R.A. Grah.) Germishuizen = PERSICARIA SENEGALENSIS FORMA ALBOTOMENTOSA
P. senegalense Meisn. subsp. senegalense = PERSICARIA SENEGALENSIS FORMA SENEGALENSIS
P. senegalense Meisn. forma albotomentosum R.A. Grah. = PERSICARIA SENEGALENSIS FORMA ALBOTOMENTOSA
P. serrulatum Lag. = PERSICARIA SERRULATA
P. tomentosum Willd. (species does not occur in southern Africa)

2201010 —Bilderdykia Dumort. = FALLOPIA
B. convolvulus (L.) Dumort. = FALLOPIA CONVOLVULUS

2201030 —PERSICARIA MILL.
1. WILSON. 1988. TELOPEA 3,2: 177—182.
2. WILSON. 1990. KEW BULL. 45,4: 621—636.
#. PRE HERBARIUM PRACTICE, FOLLOWING GERMISHUIZEN.
100 P. AMPHIBIA (L.) S.F. GRAY *
(=Polygonum amphibium L.) #
200 P. ATTENUATA (R. BR.) SOJAK SUBSP. AFRICANA K.L. WILSON
(=Polygonum pulchrum auct. non Blume) #
300 P. CAPITATA (BUCH.-HAM. EX D. DON) H. GROSS *
(=Polygonum capitatum Buch.-Ham.ex D.Don) #
400 P. HYDROPIPER (L.) SPACH. *
(=Polygonum hydropiper L.) #
600 P. LAPATHIFOLIA (L.) S.F. GRAY *
(=Polygonum lapathifolium L. subsp. maculatum (S.F. Gray) T.-Dyer & Trim.) #
(=Polygonum lapathifolium L. var. maculatum T.-Dyer & Trim.) #
700 P. LIMBATA (MEISN.) HARA *
(=Polygonum limbatum Meisn.) #
(=Polygonum piliferum Tikovsky) #
(=Polygonum schinzii C.H. Wr.) #
900 P. NEPALENSIS (MEISN.) H. GROSS *
(=Polygonum alatum Buch.-Ham. ex Spreng.) #
(=Polygonum nepalense Meisn.) #
1000 P. SENEGALENSIS (MEISN.) SOJAK FORMA ALBOTOMENTOSA (R.A. GRAH.) K.L. WILSON
(=Polygonum glutinosum Meisn. var. capensis Meisn.) #
(=Polygonum lanigerum R. Br. var. africanum Meisn.) #
(=Polygonum senegalense Meisn. subsp. albotomentosum R.A. Grah.) #
(=Polygonum senegalense Meisn. forma albotomentosum R.A. Grah.) #
1100 P. SENEGALENSIS (MEISN.) SOJAK FORMA SENEGALENSIS
(=Polygonum sambesiacum Schuster) #
(=Polygonum senegalense Meisn. subsp. senegalense) #
1200 P. SERRULATA (LAG.) WEBB & MOQ.
(=Polygonum salicifolium Willd.) #
(=Polygonum serrulatum Lag.) #

2201040 —FALLOPIA ADANS.
1. HOLUB. 1971. FOLIA GEOBOTANICA ET PHYTOTAXONOMICA BOHEMOS-LAVAKA PRAHA 6: 176.
100 F. CONVOLVULUS (L.) HOLUB
(=Bilderdykia convolvulus (L.) Dumort.) #
(=Polygonum convolvulus L.) #

2204000 —OXYGONUM BURCH. EX CAMPD.
(Note author correction)

CHENOPODIACEAE Contributed by M. Jordaan 2214000

2255000 —Arthrocnemum Moq. = HALOSARCIA, SARCOCORNIA
A. indicum (Willd.) Moq. = HALOCORNIA INDICA

2255020 —HALOSARCIA P.G. WILSON
1. WILSON. 1980. NUYTSIA 3: 63.
2. BRENAN. 1988. FZ 9,1: 147–149.
100 H. INDICA (WILLD.) P.G. WILSON
(=Arthrocnemum indicum (Willd.) Moq.) 2

2257000 —SALICORNIA L.
2. BRENAN. 1988. FZ 9,1: 153–154.
200 S. PACHYSTACHYA BUNGE EX UNG.-STERNB.
(Note author correction)
250 S. PERRIERI CHEV.

2287000 —LOPHIOCARPUS TURCZ.
3. NOWICKE. 1969. ANN. MISS. BOT. GARD. 56: 288.
4. STANNARD. 1988. FZ 9,1: 169–173.
150 L. LATIFOLIUS NOWICKE

AMARANTHACEAE Contributed by M. Jordaan 2289000

2293000 —HERMBSTAEDTIA REICHB.
3. TOWNSEND. 1988. FZ 9,1: 39–45.
25 H. ANGOLENSIS C.B. CL.
225 H. EXELLII (SUESSENG.) C.C. TOWNSEND
360 H. ODORATA (BURCH.) T. COOKE VAR. ALBI-ROSEA SUESSENG.

2312000 —CYATHULA BLUME
4. TOWNSEND. 1988. FZ 9,1: 79–87.
C. albida Lopr. = C. CYLINDRICA
C. crispa Schinz = C. LANCEOLATA
300 C. CYLINDRICA MOQ.
(=C. albida Lopr.) 4
C. hereroensis Schinz = C. LANCEOLATA
600 C. LANCEOLATA SCHINZ
(=C. crispa Schinz) 4
(=C. hereroensis Schinz) 4

2314000 —PUPALIA JUSS.
3. TOWNSEND. 1979. KEW BULL. 34: 131–142.
4. TOWNSEND. 1988. FZ 9,1: 88–93.
P. atropurpurea (Lam.) Moq. = P. LAPPACEA VAR. LAPPACEA
200 P. LAPPACEA (L.) JUSS. VAR. LAPPACEA *
(=Achyranthes atropurpurea Lam.) 4
(=Achyranthes lappacea L.) 2,4
(=Desmochaeta atropurpurea DC.) 4
(=P. atropurpurea (Lam.) Moq.) 4
300 P. LAPPACEA (L.) JUSS. VAR. VELUTINA (MOQ.) HOOK. F. *
400 P. MICRANTHA HAUMAN *

2314010 —Desmochaeta DC. = CYATHULA, PUPALIA
D. atropurpurea DC. = PUPALIA LAPPACEAE VAR. LAPPACEA

2317000 —AERVA FORSSK.
3. TOWNSEND. 1988. FZ 9,1: 93–97.
50 A. JAVANICA (BURM. F.) JUSS. EX J.A. SCHULTES
(=A. persica (Burm. f.) Merr.) 3
(=A. tomentosa Forssk.) 3
100 A. LANATA (L.) JUSS. EX J.A. SCHULTES
(Note author correction)
A. persica (Burm. f.) Merr. = A. JAVANICA
A. tomentosa Forssk. = A. JAVANICA

2318000 —NOTHOSAERVA WIGHT
1. TOWNSEND. 1988. FZ 9,1: 97–99.
100 N. BRACHIATA (L.) WIGHT

2324000 —PSILOTRICHUM BLUME
1. BAKER & CLARKE. 1909. FL. TROP. AFR. 6: 58.
2. VERDCOURT. 1964. KEW BULL. 17: 492.
3. TOWNSEND. 1988. FZ 9,1: 104.
P. africanum Oliv. = P. SCLERANTHUM
200 P. SCLERANTHUM THW.
(=P. africanum Oliv.) 2

2328000 —ACHYRANTHES L.
2. TOWNSEND. 1988. FZ 9,1: 105–109.
A. aquatica R. Br. = CENTROSTACHYS AQUATICA
A. argentea Lam. = A. ASPERA VAR. SICULA *
100 A. ASPERA L. VAR. ASPERA *
150 A. ASPERA L. VAR. PUBESCENS (MOQ.) TOWNSEND *
175 A. ASPERA L. VAR. SICULA L. *
(=A. argentea Lam.) 2
(=A. sicula (L.) All.) 2
A. atropurpurea Lam. = PUPALIA LAPPACEAE VAR. LAPPACEA
A. lappacea L. = PUPALIA LAPPACEA VAR. LAPPACEA
A. sicula (L.) All. = A. ASPERA VAR. SICULA *

2328010 —PANDIAKA (MOQ.) HOOK. F.
2. TOWNSEND. 1988. FZ 9,1: 121.
100 P. CARSONII (BAK.) C.B. CL. VAR. CARSONII

2328020 —ACHYROPSIS (MOQ.) HOOK. F.
2. TOWNSEND. 1980. KEW BULL. 34: 431–433.
3. TOWNSEND. 1988. FZ 9,1: 112.
100 A. AVICULARIS (E. MEY. EX MOQ.) COOKE & WRIGHT
(Note author correction)
200 A. LEPTOSTACHYA (E. MEY. EX MEISN.) BAK. & C.B. CL.
(Note author correction)

2328030 —CENTROSTACHYS WALL.
1. TOWNSEND. 1988. FZ 9,1: 109–110.
100 C. AQUATICA (R. BR.) WALL. EX MOQ.
(=Achyranthes aquatica R. Br.) 1

2330000 —Brayulinea Small = GUILLEMINEA KUNTH
B. densa (Willd.) Small = GUILLEMINEA DENSA

2330010 —GUILLEMINEA KUNTH
1. TOWNSEND. 1988. FZ 9,1: 122–124.
100 G. DENSA (WILLD.) MOQ.
(=Brayulinea densa (Willd.) Small) 1
(=Illecebrum densum Willd. ex Roem. & Schult.) 1

2335010 —ILLECEBRUM L. Southern African species moved to GUILLEMINEA
I. densum Willd. ex Roem. & Schult. = GUILLEMINEA DENSA

NYCTAGINACEAE Contributed by M. Jordaan 2343000

2347010 —COMMICARPUS STANDLEY
3. MEIKLE. 1978. NOTES R. BOT. GDN EDINB. 36,2: 235–249.
4. STANNARD. 1988. FZ 9,1: 15–20.
C. africanus (Lour.) Dandy (name excluded)
C. africanus auct. non (Lour.) Dandy = C. PLUMBAGINEUS
150 C. CHINENSIS (L.) HEIMERL SUBSP. NATALENSIS MEIKLE
175 C. DECIPIENS MEIKLE
250 C. FRUTICOSUS POHNERT
275 C. HELENAE (SCHULTES) MEIKLE
350 C. PILOSUS (HEIMERL) MEIKLE
375 C. PLUMBAGINEUS (CAV.) STANDLEY
(=C. africanus auct. non (Lour.) Dandy) 4

2349000 —BOERHAVIA L. Revision: L.E. Codd (PRE).
4. STANNARD. 1988. FZ 9,1: 20–25.
B. bracteata T. Cooke = B. COCCINEA

25 B. COCCINEA MILL.
(=B. bracteata T. Cooke) 4
(=B. diffusa L. var. hirsuta Heimerl) 4
(=B. diffusa L. var. viscosa (Lag. & Rodr.) Heimerl) 4
(=B. marlothii Heimerl) 4
200 B. DIFFUSA L. *
B. diffusa L. var. hirsuta Heimerl = B. COCCINEA
B. diffusa L. var. viscosa (Lag. & Rodr.) Heimerl = B. COCCINEA
B. marlothii Heimerl = B. COCCINEA

AIZOACEAE CONTINUED Contributed by M. Jordaan

2382000 —GISEKIA L.
3. GONCALVES. 1978. FZ 4: 522—525.
300 G. PHARNACIOIDES L. VAR. PHARNACIOIDES

2388000 —GLINUS L.
3. GONCALVES. 1978. FZ 4: 537—541.
400 G. OPPOSITIFOLIUS (L.) DC. VAR. OPPOSITIFOLIUS

2389000 —PHARNACEUM L.
4. GONCALVES. 1978. FZ 4: 544—546.
P. scleranthoides Sond. = SUESSENGUTHIELLA SCLERANTHOIDES

2389010 —SUESSENGUTHIELLA FRIEDR.
1. FRIEDRICH. 1955. MITT. BOT. STAATSSL. MUNCHEN 2: 60.
2. FRIEDRICH. 1960. MITT. BOT. STAATSSL. MUNCHEN 3: 616.
3. FRIEDRICH. 1966. FSWA 26: 21.
4. BOND & GOLDBLATT. 1984. JL S. AFR. BOT. SUPPL. 13: 136.
100 S. CAESPITOSA FRIEDR.
200 S. SCLERANTHOIDES (SOND.) FRIEDR.
(=Pharnaceum scleranthoides Sond.) 4

2390000 —HYPERTELIS E. MEY. EX FENZL
1. ADAMSON. 1958. JL S. AFR. BOT. 24,1: 51—59.
3. SMITH. 1966. COMMON NAMES OF S.A. PLANTS.
4. GONCALVES. 1978. FZ 4: 546—548.
50 H. ACIDA (HOOK. F.) K. MULLER
500 H. SALSOLOIDES (BURCH.) ADAMSON VAR. SALSOLOIDES

2394000 —SESUVIUM L.
1. ADAMSON. 1962. JL S. AFR. BOT. 28: 244—245.
2. GONCALVES. 1970. CONSP. FLOR. ANGOLENSIS 4: 322—327.
3. GONCALVES. 1978. FZ 4: 514—516.
S. nyasicum (Bak.) Goncalves (does not occur in southern Africa)
175 S. SESUVIOIDES (FENZL) VERDC. VAR. ANGUSTIFOLIUM (SCHINZ) GONCALVES
200 S. SESUVIOIDES (FENZL) VERDC. VAR. SESUVIOIDES

2395000 —TRIANTHEMA L.
3. GONCALVES. 1978. FZ 4: 517.
150 T. PARVIFOLIA E. MEY. EX SOND. VAR. PARVIFOLIA
(=T. triquetra Rottl. ex Willd. subsp. parvifolia (Sond.) Jeffrey) 3
175 T. PARVIFOLIA E. MEY. EX SOND. VAR. RUBENS (SOND.) ADAMSON
T. triquetra Rottl. ex Willd. subsp. parvifolia (Sond.) Jeffrey = T. PARVIFOLIA VAR. PARVIFOLIA
400 T. TRIQUETRA ROTTL. EX WILLD.

2399000 —GALENIA L.
1. ADAMSON. 1956. JL S. AFR. BOT. 22,3: 88—123.
4. BITTRICH. 1990. BOTHALIA 20,2: 217—219.
450 G. AFRICANA L. VAR. SECUNDATA ADAMSON
1650 G. GLANDULIFERA BITTRICH

2403000 —TETRAGONIA L.
1. ADAMSON. 1955. JL S. AFR. BOT. 21,3: 110—153.
3. FRIEDRICH. 1966. FSWA 28: 4.
4. GONCALVES. 1970. CONSP. FLOR. ANGOLENSIS 4: 333.
500 T. CALYCINA FENZL
(=T. karasmontana Dinter ex Adamson) 3
(=T. macroptera Pax) 3
T. karasmontana Dinter ex Adamson = T. CALYCINA
T. macroptera Pax = T. CALYCINA

MESEMBRYANTHEMACEAE 2405001
Contributed by G. Germishuizen

2405010 —ARENIFERA HERRE
50 A. KUNTZEI (SCHINZ) DINTER & SCHWANT.
(Note change in species number)

2405030 —CONOPHYTUM N.E. BR.
19250 C. MEYERI N.E. BR. VAR. RAMOSUM (LAVIS) RAWE
(Note change in species number)

2405066 —LAMPRANTHUS N.E. BR.
19150 L. SPECTABILIS (HAW.) N.E. BR. SUBSP. FUGITANS (L. BOL.) GLEN
(Note change in species number)

2405079 —MONILARIA SCHWANT.
1080 M. SCUTATA (L. BOL.) SCHWANT. SUBSP. SCUTATA
(Note change in species number)

2405116 —SPHALMANTHUS N.E. BR.
7450 S. QUARZITICUS (L. BOL.) L. BOL.
(Note change in species number)

PORTULACACEAE Contributed by M. Jordaan 2406000

2412000 —ANACAMPSEROS L. Revision: C. Gussefeld-Schneider (HEID).
2. WILD. 1961. FZ 1,2: 367.
4. BLECK. 1984. CACTUS & SUCC. JL, US 56: 266.
A. bremekampii V. Poelln. = A. RHODESICA
1610 A. LUBBERSII M.B. BLECK
2100 A. RHODESICA N.E. BR.
(=A. bremekampii Poelln.) 2
2375 A. STARKIANA V. POELLN.
(Note change in species number)

BASELLACEAE Contributed by M. Jordaan 2424000

2427000 —Boussingaultia H.B.K. (genus does not occur in southern Africa)

2428000 —ANREDERA JUSS.
1. BAILEY & BAILEY. 1977. HORTUS THIRD 81.
2. STANNARD. 1988. FZ 9,1: 161.
A. baselloides (H.B.K.) Baill. (misapplied name - specimens referable to A. cordifolia)
200 A. CORDIFOLIA (TEN.) STEENIS

CARYOPHYLLACEAE (PART A) 2429000
Contributed by M. Jordaan

2429000 —STELLARIA L.
3. DANIN. 1990. S. AFR. J. BOT. 56,3: 413.
150 S. PALLIDA (DUMORT.) PIRE

2433000 —SAGINA L.
1. DANIN. 1990. S. AFR. J. BOT. 56,3: 413.
25 S. APETALA ARD.
50 S. MARITIMA G. DON
S. sabuletorum (Gay) Lange (species does not occur in southern Africa—specimens referable to S. APETALA)

ILLECEBRACEAE Contributed by M. Jordaan 2467000

2476000 —HERNIARIA L.
1. CHAUDHRI. 1968. MED. BOT. LAB. HERB. UTRECHT 285: 354—377.
650 H. PEARSONII CHAUDHRI

CARYOPHYLLACEAE (PART B) 2488000
Contributed by M. Jordaan

2490000 —SILENE L. Revision: G. Bocquet (G).
1. SONDER. 1894. FC 1: 125—129.
4. BOCQUET. 1977. BOTHALIA 12,2: 309.
5. BOND & GOLDBLATT. 1984. JL S. AFR. BOT. SUPPL. 13: 322.
200 S. BURCHELLII OTTH VAR. PILOSELLAEFOLIA SOND.
500 S. DEWINTERI BOCQUET
(Note corrections to author and spelling)
550 S. ECKLONIANA SOND.
650 S. MUNDIANA ECKL. & ZEYH.
700 S. ORNATA AIT.

RANUNCULACEAE Contributed by M. Jordaan 2521000

2546000 —RANUNCULUS L.
600 R. PLEBEIUS R. BR. EX DC.

ANNONACEAE Contributed by M. Jordaan 2665000

2716000 —HEXALOBUS A. DC.
2. VERDCOURT. 1971. FTEA, ANNONACEAE 44—48.
100 H. MONOPETALUS (A. RICH.) ENGL. & DIELS VAR. MONOPETALUS

2729000 —ANNONA L.
2. LE THOMAS. 1969. FL. GABON 16: 1—8.
3. VERDCOURT. 1971. FTEA, ANNONACEAE 112—116.
100 A. SENEGALENSIS PERS. SUBSP. SENEGALENSIS

PAPAVERACEAE Contributed by M. Jordaan 2833000

2848000 —GLAUCIUM MILLER
2. BAILEY & BAILEY. 1977. HORTUS THIRD 512.
100 G. CORNICULATUM (L.) J.H. RUDOLPH *
(Note author correction)

2852000 —ARGEMONE L.
2. SORARU. 1976. DARWINIANA 20,3—4: 446—451.
3. EXELL & GONCALVES. 1973. FL. MOZAM. 9: 1—3.
200 A. OCHROLEUCA SWEET SUBSP. OCHROLEUCA *
(=A. subfusiformis G.B. Ownbey) 2,3
A. subfusiformis G.B. Ownbey = A. OCHROLEUCA SUBSP. OCHROLEUCA

FUMARIACEAE Contributed by M. Jordaan 2858000

2858000 —Corydalis Vent. Southern African species moved to CYSTICAPNOS
C. cracca Schl. = CYSTICAPNOS CRACCA

2858010 —Phacocapnos Bernh. = CYSTICAPNOS
P. burmannii (Eckl. & Zeyh.) Hutch. = CYSTICAPNOS GRANDIFLORA
P. cracca (Cham. & Schlechtd.) Bernh. = CYSTICAPNOS CRACCA
P. pruinosus (E. Mey.) Bernh. = CYSTICAPNOS PRUINOSA

2858020 —CYSTICAPNOS MILL.
2. LIDEN. 1986. OPERA BOTANICA 88: 105—108.
100 C. CRACCA (CHAM. & SCHLECHTD.) LIDEN
(=Corydalis cracca Schl.) 2
(=Phacocapnos cracca (Cham. & Schlechtd.) Bernh.) 2
200 C. GRANDIFLORA BERNH.
(=Phacocapnos burmannii (Eckl. & Zeyh.) Hutch.) 2
300 C. PARVIFLORA LIDEN
400 C. PRUINOSA (BERNH.) LIDEN
(=Phacocapnos pruinosus (E. Mey.) Bernh.) 2
500 C. VESICARIA (L.) FEDDE
(Note new species number)

2861000 —FUMARIA L.
2. SELL. 1964. FL. EUROP. 1: 255—258.
4. LIDEN. 1986. OPERA BOTANICA 88: 78—88.
100 F. MURALIS SOND. EX KOCH SUBSP. MURALIS *
300 F. PARVIFLORA LAM.

2861010 —DISCOCAPNOS CHAM. & SCHLECHTD.
2. BOND & GOLDBLATT. 1984. JL S. AFR. BOT. SUPPL. 13: 301.
3. LIDEN. 1986. OPERA BOTANICA 88: 104.
50 D. MUNDTII CHAM. & SCHLECHTD.
(=D. dregei Hutch.) 3
D. dregei Hutch. = D. MUNDTII

2862000 —TRIGONOCAPNOS SCHLTR.
1. LIDEN. 1986. OPERA BOTANICA 88: 105.
T. curvipes Schltr. = T. LICHTENSTEINII
200 T. LICHTENSTEINII (CHAM. & SCHLECHTD.) LIDEN
(=T. curvipes Schltr.) 1

BRASSICACEAE Contributed by M. Jordaan 2863000

2875000 —HELIOPHILA L.
5. BEAN. 1990. S. AFR. J. BOT. 56,6: 670—674.
3350 H. EPHEMERA P.A. BEAN

2949000 —BRASSICA L.
1. HEYWOOD. 1964. FL. EUROP. 1: 336.
50 B. ELONGATA EHRH. SUBSP. ELONGATA

2966000 —CARDAMINE L.
2. HILLIARD & BURTT. 1982. NOTES R. BOT. GDN EDINB. 40,2: 275—277.
400 C. TRICHOCARPA HOCHST. EX A. RICH.
(Note author correction)

2985000 —HYMENOLOBUS NUTT. EX TORREY & GRAY
1. HEYWOOD. 1964. FL. EUROP. 1: 317.
100 H. PROCUMBENS (L.) NUTT. EX TORREY & GRAY *
(Note author correction)

CAPPARACEAE Contributed by M. Jordaan 3082000

3106000 —BOSCIA LAM.
2. WILD & GONCALVES. 1973. FL. MOZAM. 12: 44—52.
250 B. FILIPES GILG

3112000 —MAERUA FORSSK.
1000 M. RACEMULOSA (A. DC.) GILG & BEN.
(Note author correction)

DROSERACEAE Contributed by M. Jordaan 3133000

3136000 —DROSERA L.
5. DEBBERT. 1987. MITT. BOT. STAATSSAMML. MÜNCHEN 23: 431—436.
6. BENNETT & CHEEK. 1990. KEW BULL. 45,2: 375—381.
150 D. ADMIRABILIS DEBBERT

PODOSTEMACEAE Contributed by M. Jordaan 3139000

3140000 —TRISTICHA THOUARS
4. CUSSET & CUSSET. 1988. BULL. MUS. NATN. HIST. NAT. PARIS 4,10: 149—177.
100 T. TRIFARIA (BORY EX WILLD.) SPRENG. SUBSP. TRIFARIA

3151000 —Dicraeia Thou. = LEDERMANNIELLA, LEIOTHYLAX
D. tenax C.H. Wr. = LEDERMANNIELLA TENAX

3151010 —Inversodicraea Engl. = LEDERMANNIELLA
I. tenax (C.H. Wr.) Engl. ex R.E. Fries = LEDERMANNIELLA TENAX
I. warmingiana (Gilg) Engl. = LEDERMANNIELLA WARMINGIANA

3151020 —LEDERMANNIELLA ENGL.
1. OBERMEYER. 1970. FSA 13: 208.
2. CUSSET. 1974. ADANSONIA 3,14: 271–275.
50 L. TENAX (C.H. WR.) C. CUSSET
(=Dicraeia tenax C.H. Wr.) 1
(=Inversodicraea tenax (C.H. Wr.) Engl. ex R.E. Fries) 2
100 L. WARMINGIANA (GILG) C. CUSSET
(=Inversodicraea warmingiana (Gilg) Engl.) 1,2
(=Sphaerothylax warmingiana Gilg) 1

3159000 —SPHAEROTHYLAX BISCH.
S. warmingiana Gilg ex Warm. = LEDERMANNIELLA WARMINGIANA

CRASSULACEAE Contributed by M. Jordaan 3161000

3164000 —COTYLEDON L.
4000 C. TOMENTOSA HARV. SUBSP. LADISMITHIENSIS (V. POELLN.) TOELKEN
(Note spelling correction)

PITTOSPORACEAE Contributed by M. Jordaan 3252000

3252000 —PITTOSPORUM BANKS EX GAERTN.
(Note author correction)
4. HILLIER. 1981. HILLIER'S MANUAL OF TREES & SHRUBS, 5TH EDN 223.
5. FRIIS. 1987. KEW BULL. 42,2: 319–333.
100 P. CRASSIFOLIUM A. CUNN.
(Note author correction)

MYROTHAMNACEAE Contributed by M. Jordaan 3282000

3282000 —MYROTHAMNUS WELW.
4. MENDES. 1978. FZ 4: 68–71.
100 M. FLABELLIFOLIUS WELW.
(Note corrections to author and spelling)

BRUNIACEAE Contributed by M. Jordaan 3283000

3286000 —LONCHOSTOMA WIKSTR.
2. STRID. 1968. BOT. NOTISER 121: 312–315.
3. BOND & GOLDBLATT. 1984. JL S. AFR. BOT. SUPPL. 13: 208–209.
50 L. ESTERHUYSENIAE STRID
300 L. PENTANDRUM (THUNB.) DRUCE
(Note author correction)

3289000 —NEBELIA NECK. EX SWEET
600 N. TULBAGHENSIS SCHLTR. EX DUEMMER
(Note author correction)

3290000 —STAAVIA DAHL
2. BOND & GOLDBLATT. 1984. JL S. AFR. BOT. SUPPL. 13: 210.
200 S. CAPITELLA (THUNB.) SOND.
(=S. globosa Sond.) 1,2
(=S. lateriflora Colozza) 1,2
(=S. trichotoma (Thunb.) Pillans) 2
S. globosa Sond. = S. CAPITELLA
600 S. GLUTINOSA (L.) DAHL
(Note author correction)
S. lateriflora Colozza = S. CAPITELLA
S. trichotoma (Thunb.) Pillans = S. CAPITELLA

3293000 —MNIOTHAMNEA NIEDENZU
50 M. BULLATA SCHLTR.
(Note new species number)

3294000 —BERZELIA BRONGN.
2. BOND & GOLDBLATT. 1984. JL S. AFR. BOT. SUPPL. 13: 207–208.
B. arachnoidea (Wendl.) Eckl. & Zeyh. = B. SQUARROSA
1300 B. SQUARROSA (THUNB.) SOND.
(=B. arachnoidea (Wendl.) Eckl. & Zeyh.) 2

HAMAMELIDACEAE Contributed by M. Jordaan 3295000

3311000 —TRICHOCLADUS PERS.
3. VERDCOURT. 1970. KEW BULL. 24,2: 345–346.
200 T. ELLIPTICUS ECKL. & ZEYH. SUBSP. ELLIPTICUS

ROSACEAE Contributed by M. Jordaan 3316000

3353000 —RUBUS L.Revision: C. Stirton (K).
6. STIRTON. 1984. BOTHALIA 15,1–2: 101–106.
7. SPIES & DU PLESSIS. 1985. BOTHALIA 15,3–4: 591–596.
400 R. CUNEIFOLIUS PURSH *
1050 R. PASCUUS BAILEY

3376000 —AGRIMONIA L.
3. MENDES. 1978. FZ 4: 27–29.
4. BOND & GOLDBLATT. 1984. JL S. AFR. BOT. SUPPL. 13: 386.
#. PRE HERBARIUM PRACTICE, FOLLOWING ARNOLD.
25 A. BRACTEATA E. MEY. EX C.A. MEY.
(=A. eupatoria L.) 3
(=A. nepalensis Don) #
A. eupatoria L. = A. BRACTEATA
A. nepalensis Don = A. BRACTEATA
A. odorata Mill. = A. PROCERA
100 A. PROCERA WALLR.
(=A. odorata Mill.) 4

3388000 —CLIFFORTIA L.
4390 C. GRANDIFOLIA ECKL. & ZEYH. VAR. DENTICULATA WEIM.
(Note spelling correction)
4450 C. GRANDIFOLIA ECKL. & ZEYH. VAR. RECURVATA WEIM.
(Note spelling correction)

FABACEAE Contributed by G. Germishuizen 3436000

3446000 —ACACIA MILL.
1. ROSS. 1975. FSA 16,1: 24.
3. VON BREITENBACH. 1989. J. DENDROL. 12: 1–10.
93150 A. NATALITIA E. MEY.
93750 A. PYCNANTHA BENTH. *

3657000 —LOTONONIS (DC.) ECKL. & ZEYH.
13. VAN WYK. 1989. S. AFR. J. BOT. 55,5: 528–532.
3070 L. DIFFORMIS B-E. VAN WYK

3669000 —CROTALARIA L. Revision: R.M. Polhill (K).
2. POLHILL. 1982. CROTALARIA IN AFRICA AND MADAGASCAR.
900 C. BREVIDENS BENTH. VAR. INTERMEDIA (KOTSCHY) POLHILL *
1700 C. DURA WOOD & EVANS SUBSP. DURA
2000 C. EREMICOLA BAK. F. SUBSP. EREMICOLA
2100 C. EXCISA (THUNB.) BAK. F. SUBSP. EXCISA
2150 C. EXCISA (THUNB.) BAK. F. SUBSP. NAMAQUENSIS POLHILL
2300 C. GAZENSIS BAK. F. SUBSP. HERBACEA POLHILL
2950 C. KURTII SCHINZ
3100 C. LANCEOLATA E. MEY. SUBSP. LANCEOLATA
3800 C. MACROCARPA E. MEY. SUBSP. MACROCARPA
3950 C. MOLLII POLHILL
4400 C. NATALITIA MEISN. VAR. NATALITIA
C. sericea Retz. = C. SPECTABILIS ROTH *

6750 C. SPECTABILIS ROTH *
(=C. sericea Retz.) 2
6800 C. SPHAEROCARPA PERR. EX DC. SUBSP. SPHAEROCARPA

3672000 —LUPINUS L.
1. STIRTON. 1988. BOTHALIA 18,1: 25–29.
100 L. ANGUSTIFOLIUS L.
200 L. CONSENTINII GUSS.
300 L. LUTEUS L.
400 L. PILOSUS MURRAY

3673000 —ARGYROLOBIUM ECKL. & ZEYH.
1. HARVEY. 1862. FC 2: 67.
1430 A. LONGIFOLIUM (MEISN.) WALP.

3690000 —TRIFOLIUM L.
3. ZACHARY & HELLER. 1984. THE GENUS TRIFOLIUM.
400 T. ALEXANDRINUM L. VAR. ALEXANDRINUM *
600 T. ARVENSE L. VAR. ARVENSE *
900 T. CAMPESTRE SCHREB. VAR. CAMPESTRE *
1300 T. HYBRIDUM L. VAR. HYBRIDUM *
1400 T. INCARNATUM L. VAR. INCARNATUM *
1500 T. MEDIUM L. VAR. MEDIUM *
1600 T. PRATENSE L. VAR. PRATENSE *
1700 T. REPENS L. VAR. REPENS *
1800 T. RESUPINATUM L. VAR. RESUPINATUM *
2000 T. SUBTERRANEUM L. VAR. SUBTERRANEUM *
2200 T. TOMENTOSUM L. VAR. TOMENTOSUM *

3703040 —OTHOLOBIUM C.H. STIRTON Revision: C.H. Stirton (K).
5. STIRTON. 1990. S. AFR. J. BOT. 56,3: 336–338.
1450 O. FUMEUM C.H. STIRTON
1950 O. NIGRICANS C.H. STIRTON

GERANIACEAE Contributed by G. Germishuizen 3924000

3924000 —GERANIUM L. Revision: O.M. Hilliard (E).
G. botrys Cav. = ERODIUM BOTRYS
G. chium L. = ERODIUM CHIUM
G. cicutarium L. = ERODIUM CICUTARIUM
G. malacoides L. = ERODIUM MALACOIDES
G. moschatum L. = ERODIUM MOSCHATUM

3927000 —ERODIUM L'HÉRIT.
2. VENTER & VERHOEVEN. 1990. S. AFR. J. BOT. 56,1: 79–92.
E. arborescens Willd. (species does not occur in southern Africa)
100 E. BOTRYS (CAV.) BERTOL.
(=Geranium botrys Cav.) 1
E. botrys (Cav.) Bertol. var. brachycarpum Godr. = E. BRACHYCARPUM
150 E. BRACHYCARPUM (GODR.) THELL.
(=E. botrys (Cav.) Bertol. var. brachycarpum Godr.) 1
170 E. CHIUM (L.) WILLD.
(=Geranium chium L.) 1
200 E. CICUTARIUM (L.) L'HÉRIT. *
(=Geranium cicutarium L.) 1
E. incarnatum L'Hérit. = PELARGONIUM INCARNATUM
400 E. MALACOIDES (L.) L'HÉRIT.
(=Geranium malacoides L.) 1
E. maritimum (Burm. f.) L'Hérit. ex Ait. (species does not occur in southern Africa)
600 E. MOSCHATUM (L.) L'HÉRIT. *
(=Geranium moschatum L.) 1

3928000 —PELARGONIUM L'HÉRIT.
23. DREYER & VAN DER WALT. 1990. S. AFR. J. BOT. 56,1: 65–67.
24. SCHELTEMA & VAN DER WALT. 1990. S. AFR. J. BOT. 56,3: 285–302.
25. VAN DER WALT, MCDONALD & VAN WYK. 1990. S. AFR. J. BOT. 56,4: 467.
26. VAN DER WALT ET AL. 1990. S. AFR. J. BOT. 56,5: 561.
27. MARAIS. 1990. S. AFR. J. BOT. 56,5: 565.
350 P. ALBUM J.J.A. VAN DER WALT
1200 P. ANTIDYSENTERICUM (ECKL. & ZEYH.) KOSTEL. SUBSP. ANTIDYSENTERICUM
1250 P. ANTIDYSENTERICUM (ECKL. & ZEYH.) KOSTEL. SUBSP. INERME SCHELTEMA
1270 P. ANTIDYSENTERICUM (ECKL. & ZEYH.) KOSTEL. SUBSP. ZONALE SCHELTEMA
8450 P. INCARNATUM (L'HÉRIT.) MOENCH
(=Erodium incarnatum L'Hérit.) 25
P. mossambicense Engl. (species does not occur in southern Africa)
11030 P. OCELLATUM J.J.A. VAN DER WALT
12950 P. PRAEMORSUM (ANDR.) F. DIETR. SUBSP. PRAEMORSUM
12970 P. PRAEMORSUM (ANDR.) F. DIETR. SUBSP. SPECIOSUM SCHELTEMA
17052 P. TORULOSUM E.M. MARAIS

TILIACEAE Contributed by R. Archer 4937000

4975000 —TRIUMFETTA L.
1. WILD. 1963. FZ 2,1: 63–78.
200 T. DEKINDTIANA ENGL. (Tropical African species collected in Venda. 2230 (MESSINA): Tshamavhudzi (-DA), R.H. Archer 432 PRU; Thengwe (-DA), A.E. van Wyk 3949 PRE, PRU.)

CONVOLVULACEAE Contributed by W.G. Welman 6968000

6972000 —FALCKIA THUNB. (Note author correction)
2. WIJNANDS & MEEUSE. 1990. BOTHALIA 20,2: 208.

6993000 —CONVOLVULUS L. (Note changes to species numbers)
1650 C. SAGITTATUS THUNB. SUBSP. GRANDIFLORUS (HALLIER F.) A. MEEUSE VAR. GRAMINIFOLIUS (HALLIER F.) BAKER & WRIGHT
1660 C. SAGITTATUS THUNB. SUBSP. GRANDIFLORUS (HALLIER F.) A. MEEUSE VAR. GRANDIFLORUS
1670 C. SAGITTATUS THUNB. SUBSP. GRANDIFLORUS (HALLIER F.) A. MEEUSE VAR. LINEARIFOLIUS (HALLIER F.) BAKER & WRIGHT
2050 C. SAGITTATUS THUNB. SUBSP. SAGITTATUS VAR. SAGITTATUS

BORAGINACEAE 7038000
Contributed by W.G. Welman & P. Herman

7038000 —CORDIA L.
4. VERDCOURT. 1989. KEW BULL. 44,1: 166.
5. MARTINS. 1990. FZ 7,4: 60–72.
400 C. MONOICA ROXB.
(=C. ovalis R. Br. ex DC.) 4
C. ovalis R. Br. ex DC. = C. MONOICA
700 C. SINENSIS LAM.

7051000 —Tournefortia L. Southern African species moved to HELIOTROPIUM
T. subulata Hochst. ex A. DC. = HELIOTROPIUM ZEYLANICUM

7052000 —HELIOTROPIUM L.
5. VERDCOURT. 1989. KEW BULL. 44,1: 166.
H. inconspicuum Dinter ex Vaupel = H. ZEYLANICUM
H. subulatum (Hochst. ex A. DC.) Vatke = H. ZEYLANICUM
2100 H. ZEYLANICUM (BURM. F.) LAM.
(=H. inconspicuum Dinter ex Vaupel) 2,5
(=H. subulatum (Hochst. ex A. DC.) Vatke) 5
(=Tournefortia subulata Hochst. ex A. DC.) 5

7056000 —TRICHODESMA R. BR.
2. MARTINS. 1990. FZ 7,4: 94—99.
150 T. AMBACENSE WELW. SUBSP. HOCKII (DE WILD.) BRUMMIT
(=T. hockii De Wild.) 2
T. hockii De Wild. = T. AMBACENSE SUBSP. HOCKII

7109000 —LITHOSPERMUM L.
3. MARTINS. 1990. FZ 7,4: 108—110.
200 L. AFROMONTANUM WEIM.
(=L. officinale auct. non L.) 3
L. officinale L. (Species does not occur in southern Africa)
L. officinale auct. non L. = L. AFROMONTANUM

7117000 —LOBOSTEMON LEHM.
2550 L. PANICULIFORMIS DC.
(Note change in species number)

VERBENACEAE Contributed by P. Herman 7138000

7151000 —STACHYTARPHETA VAHL
2. HERMAN. 1991. BOTHALIA 21,1: 57.
S. indica Vahl (Species does not occur in southern Africa)
150 S. MUTABILIS (JACQ.) VAHL *
(Note author correction)
200 S. URTICIFOLIA (SALISB.) SIMS *

7191000 —CLERODENDRUM L.
1480 C. SUFFRUTICOSUM GUERKE VAR. SUFFRUTICOSUM
(Note change in species number)

7192010 —KAROMIA P. DOP
1. FERNANDES. 1985. GARCIA DE ORTA 7,1—2: 33—46.
100 K. SPECIOSA (HUTCH. & CORBISHLEY) R. FERNANDES FORMA SPECIOSA
200 K. SPECIOSA (HUTCH. & CORBISHLEY) R. FERNANDES FORMA FLAVA (MOLDENKE) R. FERNANDES

LAMIACEAE Contributed by W.G. Welman 7210000

7328000 —MENTHA L. (Note author correction to M. longifolia)
1. TUCKER, HARLEY & FAIRBROTHERS. 1980. TAXON 29: 234.
M. longifolia (L.) L. subsp. bouvieri (Briq.) Briq. = M. LONGIFOLIA SUBSP. CAPENSIS
200 M. LONGIFOLIA (L.) L. SUBSP. CAPENSIS (THUNB.) BRIQ.
M. longifolia (L.) L. subsp. capensis (Thunb.) Briq. var. cooperi Briq. ex Cooke = M. LONGIFOLIA SUBSP. CAPENSIS
M. longifolia (L.) L. subsp. capensis (Thunb.) Briq. var. doratophylla Briq. = M. LONGIFOLIA SUBSP. CAPENSIS
M. longifolia (L.) L. subsp. capensis (Thunb.) Briq. var. obscuriceps Briq. = M. LONGIFOLIA SUBSP. CAPENSIS
M. longifolia (L.) L. subsp. capensis (Thunb.) Briq. var. salicina (Burch. ex Benth.) Briq. = M. LONGIFOLIA SUBSP. CAPENSIS
400 M. LONGIFOLIA (L.) L. SUBSP. POLYADENA (BRIQ.) BRIQ.
450 M. LONGIFOLIA (L.) L. SUBSP. WISSII (LAUNERT) CODD

7350000 —PLECTRANTHUS L'HÉRIT.
(Note changes to species numbers)
1880 P. MADAGASCARIENSIS (PERS.) BENTH. VAR. ALICIAE CODD
2950 P. SACCATUS BENTH. VAR. LONGITUBUS CODD

7359000 —SYNCOLOSTEMON E. MEY. EX BENTH.
780 S. PARVIFLORUS E. MEY. EX BENTH. VAR. LANCEOLATUS (GUERKE) CODD
(Note change in species number)

7365000 —HEMIZYGIA (BENTH.) BRIQ.
1950 H. PRETORIAE (GUERKE) ASHBY SUBSP. HETEROTRICHA CODD
(Note change in species number)

7366000 —OCIMUM L.
O. galpinii Guerke = BECIUM GRANDIFLORUM VAR. GALPINII
O. obovatum E. Mey. ex Benth. = BECIUM GRANDIFLORUM VAR. OBOVATUM

7366010 —BECIUM LINDL.
3. SEBALD. 1989. STUTTGARTER BEITR. NATURK. SER. A 437: 1—63.
270 B. GRANDIFLORUM (LAM.) PICHI-SERM. VAR. CAPITATUM (AGNEW) SEBALD
280 B. GRANDIFLORUM (LAM.) PICHI-SERM. VAR. GALPINII (GUERKE) SEBALD
(=B. obovatum (E. Mey. ex Benth.) N.E. Br. var. galpinii (Guerke) N.E. Br.) 3
(=Ocimum galpinii Guerke) 1,3
290 B. GRANDIFLORUM (LAM.) PICHI-SERM. VAR. OBOVATUM (E. MEY. EX BENTH.) SEBALD
(=B. obovatum (E. Mey. ex Benth.) N.E. Br. var. glabrius (Benth.) Cufod.) 1,3
(=B. obovatum (E. Mey. ex Benth.) N.E. Br. var. hians (Benth.) N.E. Br.) 1,3
(=B. obovatum (E. Mey. ex Benth.) N.E. Br. var. obovatum) 3
(=Ocimum obovatum E. Mey. ex Benth.) 1,3
B. obovatum (E. Mey. ex Benth.) N.E. Br. var. galpinii (Guerke) N.E. Br. = B. GRANDIFLORUM VAR. GALPINII
B. obovatum (E. Mey. ex Benth.) N.E. Br. var. glabrius (Benth.) Cufod. = B. GRANDIFLORUM VAR. OBOVATUM
B. obovatum (E. Mey. ex Benth.) N.E. Br. var. hians (Benth.) N.E. Br. = B. GRANDIFLORUM VAR. OBOVATUM
B. obovatum (E. Mey. ex Benth.) N.E. Br. var. obovatum = B. GRANDIFLORUM VAR. OBOVATUM

SOLANACEAE Contributed by W.G. Welman 7377000

7379000 —LYCIUM L.Revision: H.J.T. Venter (BLFU)
1. JOUBERT & VENTER. 1989. S. AFR. J. BOT. 55,5: 516.
750 L. GRANDICALYX JOUBERT & VENTER

7407000 —SOLANUM L. Revision: P. Jaeger (E)
11. SYMON. 1981. J. ADELAIDE BOT. GARD. 4: 1—367.
14. PHILLIPSON. 1990. S. AFR. J. BOT. 56,6: 645—647.
1250 S. CHENOPODIOIDES LAM.
(=S. gracile Dun) 11
2650 S. GIFTBERGENSE DUN.
(Note change in species number)
S. gracile Dun. = S. CHENOPODIOIDES
5800 S. SARRACHOIDES SENDTNER

SCROPHULARIACEAE (PART A) 7460000
Contributed by W.G. Welman

7467000 —APTOSIMUM BURCH. Revision: S. Brown (WIND)
1240 A. PROCUMBENS (LEHM.) STEUD. VAR. ELONGATUM (HIERN) CODD
(Note change in species number)

7471000 —DIASCIA LINK & OTTO Revision: O.M. Hilliard & B.L. Burtt (E); K. Steiner (NBG)
7. STEINER. 1989. S. AFR. J. BOT. 55,2: 250.
350 D. AUSTROMONTANA K.E. STEINER

7476000 —NEMESIA VENT. Revision: O.M. Hilliard & B.L. Burtt (E)
10. STEINER. 1989. S. AFR. J. BOT. 55,4: 405.
25 N. ACORNIS K.E. STEINER

7517000 —MANULEA L. Revision: O.M. Hilliard & B.L. Burtt (E)
6. HILLIARD. 1989. NOTES R. BOT. GDN EDINB. 46,1: 49—52.
7. HILLIARD. 1990. NOTES R. BOT. GDN EDINB. 46,3: 337—341.
50 M. ACUTILOBA HILLIARD
70 M. ADENOCALYX HILLIARD
80 M. ADENODES HILLIARD
100 M. ALTISSIMA L. F. SUBSP. ALTISSIMA
130 M. ALTISSIMA L. F. SUBSP. GLABRICAULIS (HIERN) HILLIARD
(=M. altissima L. f. var. glabricaulis Hiern) 6
M. altissima L. f. var. glabricaulis Hiern = M. ALTISSIMA SUBSP. GLABRICAULIS
150 M. ALTISSIMA L. F. SUBSP. LONGIFOLIA (BENTH.) HILLIARD
(=M. altissima L. f. var. longifolia (Benth.) Hiern) 6
M. altissima L. f. var. longifolia (Benth.) Hiern = M. ALTISSIMA SUBSP. LONGIFOLIA
250 M. ANNUA (HIERN) HILLIARD
(=Sutera annua Hiern var. annua) 6
320 M. ARIDICOLA HILLIARD
330 M. AUGEI (HIERN) HILLIARD
(=Phyllopodium augei Hiern) 6
750 M. CALCIPHILA HILLIARD
770 M. CALEDONICA HILLIARD
M. capillaris L. f. = PHYLLOPODIUM CAPILLARIS
930 M. CHRYSANTHA HILLIARD
950 M. CINEREA HILLIARD
1200 M. CRASSIFOLIA BENTH. SUBSP. CRASSIFOLIA
1230 M. CRASSIFOLIA BENTH. SUBSP. THODEANA (DIELS) HILLIARD
(=M. thodeana Diels) 6
1250 M. DECIPIENS HILLIARD
1320 M. DESERTICOLA HILLIARD
1330 M. DIANDRA HILLIARD
1520 M. EXIGUA HILLIARD
1540 M. FLANAGANII HILLIARD
M. gariepina Benth. subsp. namibensis Roessl. = M. NAMIBENSIS
1950 M. GARIESIANA HILLIARD
M. gracillima Dinter ex Range = M. NAMIBENSIS
2230 M. KARROOICA HILLIARD
2250 M. LATILOBA HILLIARD
2430 M. LINEARIFOLIA HILLIARD
M. limonioides Conrath = M. PARVIFLORA VAR. LIMONIOIDES
2520 M. MINUSCULA HILLIARD
2530 M. MONTANA HILLIARD
2540 M. MULTISPICATA HILLIARD
2550 M. NAMIBENSIS (ROESSL.) HILLIARD
(=M.gariepina Benth.subsp.namibensis Roessl.) 7
(=M. gracillima Dinter ex Range) 7
2770 M. OVATIFOLIA HILLIARD
2850 M. PARVIFLORA BENTH. VAR. LIMONIOIDES (CONRATH) HILLIARD
(=M. limonioides Conrath) 6
2900 M. PARVIFLORA BENTH. VAR. PARVIFLORA
2920 M. PAUCIBARBATA HILLIARD
(=Sutera annua Hiern var. laxa Hiern) 6
2930 M. PILLANSII HILLIARD
M. plantaginis L. f. = CROMIDON PLANTAGINIS
2970 M. PLURIROSULATA HILLIARD
2980 M. PRAETERITA HILLIARD
2990 M. PSILOSTOMA HILLIARD
3050 M. RAMULOSA HILLIARD
3070 M. RHODANTHA HILLIARD SUBSP. AURANTIACA HILLIARD
3080 M. RHODANTHA HILLIARD SUBSP. RHODANTHA
3800 M. TENELLA HILLIARD
M. thodeana Diels = M. CRASSIFOLIA SUBSP. THODEANA

7519000 —SUTERA ROTH
S. annua Hiern var. annua = MANULEA ANNUA
S. annua Hiern var. laxa Hiern = MANULEA PAUCIBARBATA
4950 S. GRACILIS (DIELS) HIERN
(Note change in species number)

7521000 —PHYLLOPODIUM BENTH.
5. HILLIARD. 1990. NOTES R. BOT. GDN EDINB. 46,3: 341.
P. augei Hiern = MANULEA AUGEI
P. baurii Hiern = SELAGO BAURII
84 P. CAPILLARE (L. F.) HILLIARD
(=Manulea capillaris L. f.) 5
(=Polycarena capillaris (L. f.) Benth.) 5
(=Polycarena parvula Schltr.) 5
89 P. CORDATUM (THUNB.) HILLIARD
(=Selago cordata Thunb.) 5
P. minimum Hiern = ZALUZIANSKYA MINIMA

7522000 —POLYCARENA BENTH.
P. capillaris (L. f.) Benth. = PHYLLOPODIUM CAPILLARE
1940 P. LILACINA HILLIARD VAR. LILACINA
(Note change in species number)
P. minima (Hiern) Levyns = ZALUZIANSKYA MINIMA
P. parvula Schltr. = PHYLLOPODIUM CAPILLARE
P. plantaginea (L. f.) Benth. = CROMIDON PLANTAGINIS

7523000 —ZALUZIANSKYA F.W. SCHMIDT Revision: O.M. Hilliard & B.L. Burtt (E)
4. HILLIARD. 1990. EDINB. J. BOT. 47,3: 345—350.
25 Z. ACROBAREIA HILLIARD
50 Z. ACUTILOBA HILLIARD
75 Z. AFFINIS HILLIARD
350 Z. BELLA HILLIARD
575 Z. COHABITANS HILLIARD
1550 Z. GLANDULOSA HILLIARD
1650 Z. GRACILIS HILLIARD
1725 Z. ISANTHERA HILLIARD
1750 Z. KAREEBERGENSIS HILLIARD
1775 Z. KARROOICA HILLIARD
1850 Z. LANIGERA HILLIARD
2150 Z. MARLOTHII HILLIARD
2250 Z. MINIMA (HIERN) HILLIARD
(=Phyllopodium minimum Hiern) 4
(=Polycarena minima (Hiern) Levyns) 4
2275 Z. MIRABILIS HILLIARD
2570 Z. PARVIFLORA HILLIARD
2630 Z. PILOSISSIMA HILLIARD
2872 Z. SANORUM HILLIARD
2877 Z. SUTHERLANDICA HILLIARD
2878 Z. SYNAPTICA HILLIARD
2890 Z. VALLISPISCES HILLIARD
2895 Z. VENUSTA HILLIARD

SELAGINACEAE Contributed by W.G. Welman 7566000

7568000 —SELAGO L.
16. HILLIARD. 1990. NOTES R. BOT. GDN EDINB. 46,3: 341.
750 S. BAURII (HIERN) HILLIARD
(=Phyllopodium baurii Hiern) 16
S. chenopodioides Diels = CHENOPODIOPSIS CHENOPODIOIDES
S. cordata E. Mey. = CROMIDON DECUMBENS
S. cordata Thunb. = PHYLLOPODIUM CORDATUM
S. decumbens Thunb. = CROMIDON DECUMBENS
S. hamulosa E. Mey. = CROMIDON HAMULOSUM
S. hirta L. f. = CHENOPODIOPSIS HIRTA

7568010 —WALAFRIDA E. MEY.
W. minuta Rolfe = CROMIDON MINUTUM
W. pusilla Roessl. = CROMIDON PUSILLUM

7568020 —CROMIDON COMPTON
2. HILLIARD. 1990. EDINB. J. BOT. 47,3: 315—337.
50 C. AUSTERUM HILLIARD
75 C. CONFUSUM HILLIARD

100 C. CORRIGIOLOIDES (ROLFE) COMPTON
(=Selago corrigioloides Rolfe) 2
200 C. DECUMBENS (THUNB.) HILLIARD
(=Selago cordata E. Mey.) 2
(=Selago decumbens Thunb.) 2
300 C. DREGEI HILLIARD
400 C. GRACILE HILLIARD
500 C. HAMULOSUM (E. MEY.) HILLIARD
(=Selago hamulosa E. Mey.) 2
600 C. MICROECHINOS HILLIARD
700 C. MINUTUM (ROLFE) HILLIARD
(=Walafrida minuta Rolfe) 2
800 C. PLANTAGINIS (L. F.) HILLIARD
(=Manulea plantaginis L. f.) 2
(=Polycarena plantaginea (L. f.) Benth.) 2
900 C. PUSILLUM (ROESSL.) HILLIARD
(=Walafrida pusilla Roessl.) 2
1000 C. VARICALYX HILLIARD

7568030 —GLOBULARIOPSIS COMPTON
2. HARTLEY & BALKWILL. 1990. S. AFR. J. BOT. 56,4: 471–481.

7568050 —CHENOPODIOPSIS HILLIARD
1. HILLIARD. 1990. EDINB. J. BOT. 47,3: 337–343.
100 C. CHENOPODIOIDES (DIELS) HILLIARD
(=Selago chenopodioides Diels) 1
200 C. HIRTA (L. F.) HILLIARD
(=Selago hirta L. f.) 1
300 C. RETRORSA HILLIARD

7570000 —GOSELA CHOISY
2. HARTLEY & BALKWILL. 1990. S. AFR. J. BOT. 56,4: 471–481.

7571000 —AGATHELPIS CHOISY
3. HARTLEY & BALKWILL. 1990. S. AFR. J. BOT. 56,4: 471–481.
100 A. DUBIA (L.) HUTCH.
(=A. parvifolia (L.) Choisy) 3
A. parvifolia (L.) Choisy = A. DUBIA

SCROPHULARIACEAE (PART B) 7572000
Contributed by W.G. Welman

7597010 —ALECTRA THUNB.
580 A. HUNDTII MELCH.
(Note change in species number)

BIGNONIACEAE Contributed by P. Herman 7662000

7713000 —TECOMARIA SPACH
2. DINIZ. 1988. FZ 8,3: 64–67.
100 T. CAPENSIS (THUNB.) SPACH SUBSP. CAPENSIS

7742000 —SPATHODEA BEAUV. Southern African species moved to MARKHAMIA
S. acuminata Klotzsch = MARKHAMIA ZANZIBARICA

7744000 —MARKHAMIA SEEM. EX BAILL.
2. DINIZ. 1988. FZ 8,3: 72–77.
M. acuminata (Klotzsch) K. Schum. = M. ZANZIBARICA
300 M. ZANZIBARICA (BOJER EX DC.) K. SCHUM.
(=M. acuminata (Klotsch) K. Schum.) 2
(=Spathodea acuminata Klotzsch) 2

PEDALIACEAE Contributed by P. Herman 7768000

7769000 —PTERODISCUS HOOK.
3. IHLENFELDT. 1988. FZ 8,3: 89–94.
300 P. NGAMICUS N.E. BR. EX STAPF
(Note author correction)

7774000 —SESAMOTHAMNUS WELW.
3. IHLENFELDT. 1988. FZ 8,3: 87–89.
300 S. LUGARDII N.E. BR. EX STAPF
(Note author correction)

7777000 —SESAMUM L.
4. IHLENFELDT. 1988. FZ 8,3: 97–106.
300 S. ANGUSTIFOLIUM (OLIV.) ENGL.
(=S. calycinum Welw. var. angustifolium (Oliv.) Ihlenf. & Seidenst.) 4
S. baumii Stapf = S. CALYCINUM SUBSP. BAUMII
400 S. CALYCINUM WELW. SUBSP. BAUMII (STAPF) SEIDENST.
(=S. baumii Stapf) 4
S. calycinum Welw. subsp. calycinum (Species does not occur in southern Africa)
S. calycinum Welw. var. angustifolium (Oliv.) Ihlenf. & Seidenst. = S. ANGUSTIFOLIUM
S. repens Engl. & Gilg (Species does not occur in southern Africa)

GESNERIACEAE Contributed by W.G. Welman 7800000

7823000 —STREPTOCARPUS LINDL. (Note changes in species numbers)
2750 S. MOLWENIENSIS HILLIARD SUBSP. ESHOWICUS HILLIARD & BURTT
3850 S. PRIMULIFOLIUS GAND. SUBSP. FORMOSUS HILLIARD & BURTT

LENTIBULARIACEAE Contributed by P. Herman 7898000

7899000 —GENLISEA A. ST. HIL.
2. TAYLOR. 1988. FZ 8,3: 40–42.
100 G. HISPIDULA STAPF

7901000 —UTRICULARIA L.
5. TAYLOR. 1988. FZ 8,3: 9–38.
U. exoleta R. Br. = U. GIBBA
U. gibba L. subsp. exoleta (R. Br.) P. Tayl. = U. GIBBA
750 U. GIBBA L.
(=U. exoleta R. Br.) 5
(=U. gibba L. subsp. exoleta (R. Br.) P. Tayl.) 5
1200 U. REFLEXA OLIV.
1400 U. SCANDENS BENJ.
U. spiralis J.E. Sm. var. tortilis (Oliv.) P. Tayl. = U. TORTILIS
1700 U. TORTILIS OLIV.
(=U.spiralis J.E.Sm.var.tortilis (Oliv.) P. Tayl.) 5

ACANTHACEAE Contributed by W.G. Welman 7906000

7972000 —CRABBEA HARV. Revision: S. Buys (PUC)
250 C. GALPINII C.B. CL.
(Note change in species number)

7973000 —BARLERIA L.
7. BALKWILL, BALKWILL & VINCENT. 1990. S. AFR. J. BOT. 56,5: 571.
1450 B. GREENII M-J. & K. BALKWILL
4850 B. SPLENDENS E.A. BRUCE
(Note change in species number)

7978000 —SCLEROCHITON HARV.
3. VOLLESEN. 1991. KEW BULL. 46,1: 1–50.
50 S. APICULATUS VOLLESEN
(=S. coeruleus auct. non (Lindau) S. Moore) 3
S. coeruleus (Lindau) S. Moore (Species does not occur in southern Africa)
S. coeruleus auct. non (Lindau) S. Moore = S. APICULATUS
450 S. SPECIES A

7983000 —Pseudoblepharis Baill. (Genus does not occur in southern Africa)

7985000 —CROSSANDRA SALISB.
3. VOLLESEN. 1990. KEW BULL. 45,3: 503–534.
200 C. GREENSTOCKII S. MOORE
(=C. pungens auct. non Lindau) 3
C. pungens Lindau (Species does not occur in southern Africa)
C. pungens auct. non Lindau = C. GREENSTOCKII

8026000 —PERISTROPHE NEES Revision: K. Balkwill (NU)
7. BALKWILL & GETLIFFE NORRIS. 1989. S. AFR. J. BOT. 55,2: 254.
260 P. DECORTICANS BALKWILL

8048000 —ECBOLIUM KURZ
4. VOLLESEN. 1989. KEW BULL. 44,4: 638—680.
E. amplexicaule S. Moore (Species does not occur in southern Africa)
E. amplexicaulis auct. non S. Moore = E. GLABRATUM
200 E. CLARKEI HIERN VAR. CLARKEI
250 E. CLARKEI HIERN VAR. PUBERULUM VOLLESEN
350 E. GLABRATUM VOLLESEN
(=E. amplexicaulis auct. non S. Moore) 4
E. hamatum (Klotzsch) C.B. Cl. = MEGALOCHLAMYS HAMATA
E. revolutum (Lindau) C.B. Cl. = MEGALOCHLAMYS REVOLUTA SUBSP. COGNATA

8049000 —SIPHONOGLOSSA OERST.
1. IMMELMAN. 1989. BOTHALIA 19,2: 209—213.

8061000 —MEGALOCHLAMYS LINDAU
2. VOLLESEN. 1989. KEW BULL. 44,4: 605—638.
50 M. HAMATA (KLOTZSCH) VOLLESEN
(=Ecbolium hamatum (Klotzsch) C.B. Cl.) 2
75 M. KENYENSIS VOLLESEN SUBSP. AUSTRALIS VOLLESEN
200 M. REVOLUTA (LINDAU) VOLLESEN SUBSP. COGNATA (N.E. BR.) VOLLESEN
(=Ecbolium revolutum (Lindau) C.B. Cl.) 2
(=Schwabea revoluta Lindau) 2

8091000 —Schwabea Endl. = MEGALOCHLAMYS
S. revoluta Lindau = MEGALOCHLAMYS REVOLUTA SUBSP. COGNATA

RUBIACEAE Contr. by W.G. Welman & P. Herman 8119000

8136060 —KOHAUTIA CHAM. & SCHLECHTD. Revision: D. Mantell (WU)
2. MANTELL. 1989. FZ 5,1: 85—101.
K. brachyloba (Sond.) Brem. = K. CAESPITOSA SUBSP. BRACHYLOBA
575 K. CAESPITOSA SCHNIZL. SUBSP. BRACHYLOBA (SOND.) D. MANTELL
(=Hedyotis brachyloba Sond.) 2
(=K. brachyloba (Sond.) Brem.) 2
(=K. caespitosa Schnizl. var. delagoensis (Schinz) Brem.) 1,2
(=Oldenlandia brachyloba (Sond.) Kuntze) 2
(=Oldenlandia delagoensis Schinz) 2
K. caespitosa Schnizl. var. delagoensis (Schinz) Brem. = K. CAESPITOSA SUBSP. BRACHYLOBA
800 K. CYNANCHICA DC.
(=K. gracilifolia Brem.) 2
(=K. omahekensis (Krause) Brem.) 2
(=K. raphidophylla Brem.) 2
(=Oldenlandia omahekensis Krause) 2
K. gracilifolia Brem. = K. CYNANCHICA
1250 K. MICROFLORA D. MANTELL
K. omahekensis (Krause) Brem. = K. CYNANCHICA
1400 K. RAMOSISSIMA DINTER EX BREM.
(=Oldenlandia filifolia Krause) 2
K. raphidophylla Brem. = K. CYNANCHICA
K. setifera DC. = K. VIRGATA
1550 K. SUBVERTICILLATA (K. SCHUM.) D. MANTELL SUBSP. SUBVERTICILLATA
(=Oldenlandia sordida Krause) 2
(=?Oldenlandia trothae Krause) 2
1600 K. VIRGATA (WILLD.) BREM.
(=K. setifera DC.) 2

8136140 —AGATHISANTHEMUM KLOTZSCH
3. MANTELL. 1989. FZ 5,1: 107—111.
100 A. BOJERI KLOTZSCH SUBSP. BOJERI
(Note change in rank)

8136200 —OLDENLANDIA L. Revision: D. Mantell (WU)
3. MANTELL. 1989. FZ 5,1: 120—142.
O. brachyloba (Sond.) Kuntze = KOHAUTIA CAESPITOSA SUBSP. BRACHYLOBA
615 O. CORYMBOSA L. VAR. LINEARIS (DC.) VERDC.
O. delagoensis Schinz = KOHAUTIA CAESPITOSA SUBSP. BRACHYLOBA
O. filifolia Krause = KOHAUTIA RAMOSISSIMA
O. omahekensis Krause = KOHAUTIA CYNANCHICA
O. sordida Krause = KOHAUTIA SUBVERTICILLATA SUBSP. SUBVERTICILLATA
O. trothae Krause = ?KOHAUTIA SUBVERTICILLATA SUBSP. SUBVERTICILLATA

8136210 —Hedyotis L. = AGATHISANTHEMUM, CONOSTOMIUM, KOHAUTIA, OLDENLANDIA, PENTODON
H. brachyloba Sond. = KOHAUTIA CAESPITOSA SUBSP. BRACHYLOBA

8285000 —GARDENIA ELLIS
4. GLEN. 1982. FLOWER PL. AFR. 47: PL. 1863.
900 G. THUNBERGIA THUNB.
(Note author correction)

8359000 —PACHYSTIGMA HOCHST. Revision: P.D.F. Kok (PRU)
3. KOK, BOSHOFF & VAN WYK. 1989. S. AFR. J. BOT. 55,6: 560.
50 P. BOWKERI ROBYNS

8438000 —ANTHOSPERMUM L.
2. PUFF. 1989. FZ 5,1: 150—159.
A. ericoideum Krause = A. RIGIDUM SUBSP. PUMILUM
A. humile N.E. Br. = A. RIGIDUM SUBSP. PUMILUM
A. pumilum Sond. subsp. pumilum = A. RIGIDUM SUBSP. PUMILUM
A. pumilum Sond. subsp. rigidum (Eckl. & Zeyh.) Puff = A. RIGIDUM SUBSP. RIGIDUM
A. pumilum Sond. var. pilosum Phill. = A. RIGIDUM SUBSP. PUMILUM
1770 A. RIGIDUM ECKL. & ZEYH. SUBSP. PUMILUM (SOND.) PUFF
(=A. ericoideum Krause) 2
(=A. humile N.E. Br.) 2
(=A. pumilum Sond.) 2
(=A. pumilum Sond. var. pilosum Phill.) 2
1800 A. RIGIDUM ECKL. & ZEYH. SUBSP. RIGIDUM
(=A. pumilum Sond. subsp. rigidum (Eckl. & Zeyh.) Puff) 2

8443000 —CARPACOCE SOND.
150 C. SCABRA (THUNB.) SOND. SUBSP. RUPESTRIS PUFF
(Note change in species number)

8475000 —SPERMACOCE GAERTN.
2. VERDCOURT. 1989. FZ 5,1: 165—188.
50 S. DESERTI N.E. BR.
400 S. SUBVULGATA (K. SCHUM.) GARCIA VAR. SUBVULGATA

CUCURBITACEAE Contributed by W.G. Welman 8548000

8598000 —CITRULLUS ECKL. & ZEYH.
3. DE WINTER. 1990. BOTHALIA 20,2: 209—211.
300 C. REHMII DE WINTER

8599000 —CUCUMIS L.
850 C. MELO L. (Note change in species number)

CAMPANULACEAE Contributed by W.G. Welman 8644000

8668000 —WAHLENBERGIA SCHRAD. EX ROTH
(Note changes in species numbers)
9250 W. POLYTRICHIFOLIA SCHLTR. SUBSP. DRACOMONTANA HILLIARD & BURTT
10625 W. ROELLIFLORA SCHLTR. & V. BREHM.
12850 W. TRANSVAALENSIS V. BREHM.

8670000 —LIGHTFOOTIA L'HÉRIT.
(Note changes in species numbers)
1675 L. DINTERI ENGL. EX DINTER
1850 L. DIVARICATA BUEK VAR. DIVARICATA
2450 L. LONGIFOLIA A. DC. VAR. CORYMBOSA ADAMSON
3950 L. RUBENS BUEK VAR. BRACHYPHYLLA ADAMSON

LOBELIACEAE Contributed by W.G. Welman 8681000

8681000 —CYPHIA BERG. (Note change in species number)
3875 C. SYLVATICA ECKL. VAR. SALICIFOLIA (PRESL) E. WIMM.

8694000 —LOBELIA L. (Note changes in species numbers)
1350 L. CHAMAEPITYS LAM. VAR. CERATOPHYLLA (PRESL) E. WIMM.
8220 L. STENOSIPHON (ADAMSON) E. WIMM.
8450 L. TOMENTOSA L. F.

ASTERACEAE Contr. by W.G. Welman & P. Herman 8729000

8764000 —CORYMBIUM L.
4. WEITZ. 1989. S. AFR. J. BOT. 55,6: 598–629.
700 C. VILLOSUM L. F. (Note author correction)

8862000 —PTERONIA L.
8. BRUSSE. 1990. BULL. JARD. BOT. NAT. BELG. 60: 151–154.
1850 P. DIOSMIFOLIA BRUSSE

8901000 —ERIGERON L.
E. floribundus (Kunth) Sch. Bip. = CONYZA ALBIDA
E. sumatrensis Retz. = CONYZA ALBIDA

8926000 —CONYZA LESS.
5. DANIN. 1990. S. AFR. J. BOT. 56,3: 412–413.
125 C. ALBIDA SPRENG. *
(=C. floribunda Kunth) 5
(=C. sumatrensis (Retz.) E.H. Walker) 5
(=Erigeron floribundus (Kunth) Sch. Bip.) 5
(=Erigeron sumatrensis Retz.) 5
C. floribunda Kunth = C. ALBIDA
C. sumatrensis (Retz.) E.H. Walker = C. ALBIDA

8951000 —NICOLASIA S. MOORE
850 N. STENOPTERA (O. HOFFM.) MERXM. SUBSP. MAKARIKARIENSIS (BREM. & OBERM.) MERXM.
(Note change in species number)

8967000 —IFLOGA CASS. (Note changes in species numbers)
150 I. ANOMALA HILLIARD
675 I. PARONYCHIOIDES (DC.) FENZL

8992000 —GNAPHALIUM L.
G. capitatum Lam. = METALASIA CAPITATA
G. densum Lam. = METALASIA DENSA
G. distans Schrank = METALASIA DISTANS
G. divergens Thunb. = METALASIA DIVERGENS
G. fastigiatum Thunb. = METALASIA FASTIGIATA

8995000 —PETALACTE D. DON
50 P. CANESCENS DC. (Note change in species number)

9006000 —HELICHRYSUM MILL. (Note changes in species numbers)
4050 H. CYMOSUM (L.) D. DON SUBSP. CALVUM HILLIARD
7450 H. GRISEOLANATUM HILLIARD
18080 H. SUBFALCATUM HILLIARD

9037000 —STOEBE L.
S. gnaphalodes Thunb. = METALASIA PULCHERRIMA FORMA PULCHERRIMA
1100 S. GOMPHRENOIDES (LAM.) BERG.
(Note author correction)

9042000 —PTEROTHRIX DC.
4. BRUSSE. 1990. BOTHALIA 20,1: 67.
350 P. TECTA BRUSSE

9043000 —METALASIA R. BR.
1. PILLANS. 1954. JL S. AFR. BOT. 20: 47.
2. KARIS. 1989. OPERA BOTANICA 99: 1–150.
50 M. ACUTA KARIS
225 M. ALBESCENS KARIS
M. aristata DC. = M. DENSA
M. barnardii L. Bol. = M. MURALTIIFOLIA
M. bolusii L. Bol. = M. CAPITATA
800 M. BREVIFOLIA (LAM.) LEVYNS
(=M. intermedia DC.) 2
(=M. fasciculata (Berg.) D. Don.) 1
M. caespitosa Levyns = M. PULCHELLA
850 M. CALCICOLA KARIS
875 M. CAPITATA (LAM.) LESS.
(=Gnaphalium capitatum Lam.) 2
(=M. bolusii L. Bol.) 2
925 M. COMPACTA ZEYH. EX SCH. BIP.
M. concinna Harv. = M. FASTIGIATA
1010 M. DENSA (LAM.) KARIS
(=Gnaphalium densum Lam.) 2
(=M. aristata DC.) 2
(=M. polyanthos (Thunb.) D. Don) 2
(=M. stricta Less.) 2
M. depressa Harv. = M. DIVERGENS SUBSP. DIVERGENS
1020 M. DISTANS (SCHRANK.) DC.
(=Gnaphalium distans Schrank) 2
1030 M. DIVERGENS (THUNB.) D. DON SUBSP. DIVERGENS
(=Gnaphalium divergens Thunb.) 2
(=M. depressa Harv.) 2
1035 M. DIVERGENS (THUNB.) D. DON SUBSP. FUSCA KARIS
1040 M. DREGEANA DC.
1100 M. ERUBESCENS DC.
(=M. nitidula Harv.) 2
M. fasciculata (Berg.) D. Don. = M. BREVIFOLIA
(Note author correction)
1150 M. FASTIGIATA (THUNB.) D. DON
(=Gnaphalium fastigiatum Thunb.) 2
(=M. concinna Harv.) 2
(=M. speciosa Hutch.) 2
M. gnaphalodes Druce = M. PULCHERRIMA FORMA PULCHERRIMA
1400 M. HUMILIS KARIS
M. incurva Pillans = M. PHILLIPSII SUBSP. INCURVA
M. intermedia DC. = M. BREVIFOLIA
1650 M. INVERSA KARIS
M. langebergensis Salter = M. MASSONII
1950 M. LUTEOLA KARIS
2000 M. MASSONII S. MOORE
(=M. langebergensis Salter) 2
2050 M. MONTANA KARIS
2075 M. MURALTIIFOLIA DC.
(=M. barnardii L. Bol.) 2
M. nitidula Harv. = M. ERUBESCENS
2250 M. OLIGOCEPHALA KARIS
M. phylicoides D. Don (name doubtful)
2325 M. PHILLIPSII L. BOL. SUBSP. INCURVA (PILLANS) KARIS
(=M. incurva Pillans) 2
2350 M. PHILLIPSII L. BOL. SUBSP. PHILLIPSII
2400 M. PLICATA KARIS
M. polyanthos (Thunb.) D. Don = M. DENSA
(Note author correction)

2450 M. PULCHELLA (CASS.) KARIS
(=M. caespitosa Levyns) 2
M. pulcherrima Less. var. pallescens Harv. = M. PULCHERRIMA FORMA PALLESCENS
2475 M. PULCHERRIMA LESS. FORMA PALLESCENS (HARV.) KARIS
(=M. pulcherrima Less. var. pallescens Harv.) 2
2500 M. PULCHERRIMA LESS. FORMA PULCHERRIMA
(=M. gnaphalodes Druce) 2
(=Stoebe gnaphalodes Thunb.) 1,2
2550 M. PUNGENS D. DON
2850 M. ROGERSII S. MOORE
M. schlechteri L. Bol. = PLANEA SCHLECHTERI
3050 M. SERRATA KARIS
3075 M. SERRULATA KARIS
M. speciosa Hutch. = M. FASTIGIATA
M. stricta Less. = M. DENSA
3225 M. TENUIS KARIS
3275 M. TRIVIALIS KARIS
3300 M. UMBELLIFORMIS KARIS

9043010 —CALOTESTA KARIS
1. KARIS. 1990. BOT. J. LINN. SOC. 102: 23–36.
100 C. ALBA KARIS

9043020 —HYDROIDEA KARIS
1. KARIS. 1990. BOT. J. LINN. SOC. 102: 23–36.
100 H. ELSIAE (HILLIARD) KARIS
(=Atrichantha elsiae Hilliard) 1

9043030 —PLANEA KARIS
1. KARIS. 1990. BOT. J. LINN. SOC. 102: 23–36.
100 P. SCHLECHTERI (L. BOL.) KARIS
(=Metalasia schlechteri L. Bol.) 1

9045010 —ATRICHANTHA HILLIARD & BURTT
A. elsiae Hilliard = HYDROIDEA ELSIAE

9336000 —PHYMASPERMUM LESS. EMEND. KALLERSJO
3. BRUSSE. 1989. BOTHALIA 19,1: 29.
205 P. ARGENTEUM BRUSSE
230 P. EQUISETOIDES THELL.
(Note change in species number)
525 P. SCOPARIUM (DC.) KALLERSJO
(Note change in species number)

9337010 —INEZIA PHILL.
2. BRUSSE. 1989. BOTHALIA 19,1: 27.
200 I. SPECIOSA BRUSSE

9411000 —SENECIO L. Revision: B. Nordenstam (S), L.P.D. Vincent (J)
S. galpinii (Hook. f.) Hook. f. = KLEINIA GALPINII
(Note author correction)
12620 S. HIRSUTILOBUS HILLIARD
(Note change in species number)
14280 S. LAEVIGATUS THUNB. VAR. INTEGRIFOLIUS HARV.
(Note change in species number)
14960 S. LEUCOGLOSSUS SOND.
(Note change in species number)
15250 S. LITTOREUS THUNB. VAR. HISPIDULUS HARV.
(Note change in species number)
18920 S. PANDURATUS LESS.
(Note change in species number)

9411050 —KLEINIA MILL.
2. HALLIDAY. 1988. HOOKER'S ICON. PL. T. 3878.
300 K. GALPINII HOOK. F.
(Note author correction)
(=Senecio galpinii (Hook. f.) Hook. f.) 1

9427000 —OSTEOSPERMUM L.
6. NORLINDH. 1965. MITT. BOT. STSAMML. MÜNCH. 5: 646–647.
4450 O. MURICATUM E. MEY. EX DC. SUBSP. LONGIRADIATUM T. NORL.
(Note change in species number)
4850 O. PINNATUM (THUNB.) T. NORL. VAR. BREVE T. NORL.
4900 O. PINNATUM (THUNB.) T. NORL. VAR. PINNATUM
5050 O. POLYGALOIDES L. VAR. LATIFOLIUM T. NORL.
(Note change in species number)

9432000 —ARCTOTIS L.
1150 A. BELLIDIASTRUM S. MOORE
(Note change in species number)

9437000 —CULLUMIA R. BR. EX AIT.
1575 C. SETOSA (L.) R. BR. VAR. MICROCEPHALA ROESSL.
(Note change in species number)

NATIONAL BOTANICAL INSTITUTE

SOUTH AFRICA

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(31st August 1991)

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Reynolds, Ms P.Y. Head: Kirstenbosch Library
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Lategan, Mrs B.F. Library Assistant

Reynolds, Ms P.Y. B.A., H.L.D.S., B.Proc. Senior Librarian (Kirstenbosch Library, Cape Town)

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Brink, Mrs S.S. Dip. (Typing). Senior Typist. Typesetting, lay-out, computers
Condy, Ms G.S. M.A. Botanical Artist. Colour/pen-and-ink art work, exhibitions, curation
Du Plessis, Mrs E. B.Sc. Hons, S.E.D. Chief Liaison Officer. Editing, translating, lay-out
Momberg, Mrs B.A. B.Sc. (Entomology & Zoology). Principal Research Technician. Editing, lay-out
Mulvenna, Mrs J.M. Dip. (Typing). Senior Typist. Word processing, data capture

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Dry, D.H. Curator: Pretoria NBG
Engelbrecht, B. Curator: Karoo NBG
Heilgendorff, J.P. Curator: Harold Porter NBG
Kluge, J.P. Curator: Lowveld NBG
Oliver, I.B. Curator: Orange Free State NBG
Tarr, B.B. Curator: Natal NBG
Winter, J.H.S. Curator: Kirstenbosch NBG

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Linde, D.C. N.T.C. (Technician and Inspector of Works). Control Works Inspector
Manasse, S.P. Dip. (Masonry). Artisan
Petersen, R.H.W. Artisan's Assistant

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Abrahams, F. General Assistant I
Abrahamse, S.J. Foreman
Dramat, N. General Assistant I
Harper, C.J. Driver
Martinka, A.G. General Assistant II
Rex, G. General Assistant I
Van Coller, A.E. General Assistant I
Visser, C.J.J. General Assistant II

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Kecela, S. General Assistant I
Kumeke, A.M. General Assistant II
Made, M.A. General Assistant I
Madumane, M. General Assistant II
Makubalo, F.N. General Assistant III
Makubalo, J. General Assistant II
Mcinziba, S.S. General Assistant I
Monisi, M.M. General Assistant II
Mpeke, Mrs E.N. General Assistant I
Mtetwa, A.M. General Assistant III
Ngqwazi, D.C.T. General Assistant III
Nkoloti, P.M. General Assistant II
Perry, Miss P.L. B.Sc. (Hort.), M.Sc. Principal Research Technician
Qumba, G.A. General Assistant I
Radebe, M.B. General Assistant III
Sibeko, L.A. General Assistant III
Sibozo, N.E. Driver
Simane, D.K. Foreman Gr. I
Smit, Mrs A.C. Senior Provisioning Administration Clerk
Theoha, P.P. General Assistant III
Tuswa, M.H. General Assistant I
Viljoen, D.M. N.D. (Hort.). Senior Research Technician
Yekiso, S.M. General Assistant II

KIRSTENBOSCH NBG—CAPE TOWN

Winter, J.H.S. N.D. (Hort.). Control Research Technician

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Arends, Miss L.D. Assistant, Plant Recording
Basson, W. Head, Cleaning Services
Crowie, A.C. Driver
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De Kock, Mrs M.E. General Assistant, Cleaning Services

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Grace, T. Storeman/Sen. Provisioning Administration Clerk
Haynie, R. General Assistant, Workshop
Jacobs, A.P. Information Officer
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Jacobs, K.C. Factotum
Jansen, K.J. Driver
Labuschagne, Mrs C.E. B.Sc. (Hon). Education Officer
Marent, Mrs. H.C. Senior Provisioning Administration Clerk, Plant Recording
McLean, N.S. General Assistant, Workshop
Newman, W. Driver, Workshop
Nicoll, Mrs. R.C. Senior Provisioning Administration Clerk
Trautman, C.E. Artisan/Supervisor, Workshop
Williams, W.P. Foreman. Drivers

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Adams, A.K. General Assistant. Aliens
Adams, J. General Assistant. Estate & Trails
Adonis, S.J. General Assistant. Aliens
Alfreds, M. General Assistant. Aliens
Andrews, M.M. General Assistant. Estate & Trails
Arendse, B.A. General Assistant. Aliens
Baadjies, I. General Assistant. Estate & Trails
Bezuidenhout, A.K. General Assistant. General maintenance
Bouwers, G.G. General Assistant. Construction
Claasen, F. General Assistant. Aliens
Dollie, Y. General Assistant. Estate & Trails
Fienies, C. General Assistant. Aliens
Geswind, A.J. General Assistant. Estate & Trails
Grootboom, C.J. General Assistant. Construction
Hendricks, M. General Assistant. Estate & Trails
Hope, C. General Assistant. Construction
Isaacs, M. General Assistant. Aliens
Jackson, P. General Assistant. Lawnmowers
Jaftha, R. General Assistant. General maintenance
Jaftha, W.R. General Assistant. Construction
Kayster, G.J. Foreman. Construction
Koopman, C. General Assistant. Estate & Trails
Kuscus, G.W. Foreman. General maintenance
Matthews, I.N. General Assistant. Estate & Trails
McLean, A. General Assistant. Aliens
Mitchells, G. Foreman. Estate & Trails
Petersen, J. General Assistant. Aliens
Petersen, N.H. General Assistant. Construction
Plaatjies, D. General Assistant. Aliens
Plaatjies, M.P. General Assistant. Estate & Trails
Rhode, W.C. General Assistant. Estate & Trails
Sampson, J. Foreman. Aliens
Sampson, J.J. General Assistant. Lawnmowers
Snyders, S.G. General Assistant. Lawnmowers
Solomons, G. General Assistant. Aliens
Solomons, S. General Assistant. Construction
Van der Meulen, C.A. General Assistant. Construction
Van Gusling, E.J. Foreman. Lawnmowers
Willis, J.P.P. General Assistant. Estate & Trails
Wyngaard, D.J. General Assistant. Estate & Trails

GARDEN

Adonis, A. General Assistant. Sales, Ericas
Adams, H. General Assistant. New development
Balabala, L. General Assistant. Sales
Benjamin, R.C.J. Foreman. Annuals
Benjamin, W.J. General Assistant. Sales
Boonzaaier, I. General Assistant. General garden
Booysen, J.D. General Assistant. Annuals
Bowler, J.H. Foreman. New development
Bowler, M.A. General Assistant. Annuals
Claasens, D. General Assistant. New development
Crowie, H.R. General Assistant. General garden
Crowie, R.W. Foreman. General garden
Du Preez, A.C. General Assistant. General garden
Haynie, L. General Assistant. General garden
Hendricks, S. General Assistant. Proteas
Jansen, W. General Assistant. Annuals
Jenkins, A. General Assistant. Snr Nurseryman
Johnson, J. General Assistant. Annuals
Julius, J.A. General Assistant. Sales
Lewis, D.P. General Assistant. Proteas
Lewis, P.S. General Assistant. Proteas
Loft, G.E. General Assistant. Proteas
Lukas, K. General Assistant. General garden
Manuel, D.R. General Assistant. Annuals
Maxwell, P.E. General Assistant. New development
McKlein, P. General Assistant. Sales
Morris, J.N.M. General Assistant. Proteas
Palmer, I. General Assistant. General garden
Petersen, A. General Assistant. Sales
Philander, N. General Assistant. New development
Pietersen, J. General Assistant. New development
Plaatjies, S.D. General Assistant. Proteas
Ruiters, M. General Assistant. New development
Sampson, D. General Assistant. Sales
Sampson, R. General Assistant. General garden
Solomons, E.A. General Assistant. Proteas
Solomons, K.J. General Assistant. Proteas
Van der Westhuizen, A.J. Foreman. Proteas
Van Rooy, K. General Assistant. Annuals
Williams, M.L.J. General Assistant. New development

NURSERY

Saunders, R.C. N.T.C. III (Hort.). Chief Research Technician. Head: Nursery

Adams, H. Foreman, Plant utilization
Adonis, M. General Assistant. Nurseryman
Apolis, A. General Assistant
August, C. General Assistant. Seed room
Berman, R.C. Security
Britz, R.M. N.D. (Forestry). Principal Research Technician. Head: Security
Carrol, R.R. General Assistant
Daniels, A. General Assistant. Plant utilization
Davids, M. General Assistant. Seed room
Davids, M.I. General Assistant. Senior Nurseryman
Davids, N. General Assistant. Nurseryman
Davids, M. General Assistant. Senior Nurseryman
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Eksteen, M. General Assistant. Succulents
Erasmus, S. Security
Francis, J. General Assistant. Plant utilization
Goliath, Mrs L. General Assistant. Seed room
Gould, Mrs M. N.D. (Hort.). Senior Research Technician
Hendricks, B.D. General Assistant. Succulents
Hitchcock, A.N. N.D. (Hort.), N.H.D. (Hort.). Senior Research Technician
Jacobs, C.W. General Assistant. Nurseryman
Jacobs, D.G. Foreman. Plant utilization
Jacobs, E.C. General Assistant. Seed room
Jacobs, H.C. Security
Jamieson, Mrs H.G. N.D. (Parks & Recreation). Research Technician
January, C. Security
January, P.C. General Assistant. Plant utilization
Juta, E.C. General Assistant. Plant utilization
Kettledas, P.G. General Assistant. Nurseryman
King, O. General Assistant. Nurseryman
Koma, B. General Assistant. Succulents
Kotze, F.G. N.T.C. III (Hort.). Principal Research Technician
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Lewin, T.B. General Assistant. Nurseryman
Manuel, I.P. Foreman. Seed room
Marthinus, E. General Assistant. Succulents
Mulder, G.R. General Assistant. Nurseryman
Notten, Miss A.L. Student (Temporary)
Pick, Miss U.M. General Assistant. Seed room
Powrie, Miss F.J. B.Sc. (Hon) N.D. (Hort.), Senior Research Technician
Rudolph, A. Security
Sardien, T.P. General Assistant. Group Leader, succulents
Sauls, C.J. General Assistant. Nurseryman
Siljeur, H.V. General Assistant. Security
Smith, D. General Assistant
Solomons, T. Foreman. Security
Tamboer, J.S. Foreman. Nursery
Thomas, Mrs M.L. Senior Research Technician
Van der Walt, Mrs L.E. N.D. (Hort.). Research Technician
Van Jaarsveld, E.J. M.Sc. N.D. (Hort.). Chief Research Technician
Van Rooyen, Miss S. General Assistant. Seed room
Van Schalkwyk, J. General Assistant. Succulents
Von Somnitz, Miss B.D. N.D. (Hort.). Kirstenbosch Scholar (Temporary)
Williams, G.C. General Assistant. Security

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Froneman, W.C. N.D. (Nature Conservation & Management), N.D. (Parks & Recreation Admin.), N.T.C. III (Hort.). Principal Research Technician
Hurter, P.J.H. B.Sc. Research Technician
Khoza, D.E. General Assistant
Khoza, F.D. General Assistant
Khumalo, N.S. General Assistant
Khumalo, S.S. General Assistant
Magagula, N.R. General Assistant
Mahlahlubane, F.J. General Assistant
Makamo, Mrs J.E. General Assistant
Makhubela, B.J. General Assistant
Mantseke, N.A. General Assistant
Maqungo, Miss V.L.B. General Assistant
Mazibuko, F.E. General Assistant
Mdhluli, M.B. General Assistant
Mdluli, M.E. General Assistant
Mdluli, S. General Assistant
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Sibure, W.F. General Assistant
Sigudla, B.M. General Assistant
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Dlungwane, R. Foreman
Gabuza, A. General Assistant II
Gates, Ms J.E. N.D. (Hort.), N.D. (Parks & Recreation Admin.). Senior Horticulturist. *Kniphofia*, forest species.
Leitch, N.G. Nat. Cert. (Horticulture & Gardening) (N.Z.), Royal New Zealand Inst. Cert. (Amenity Horticulture). Research Technician. Computers, rare and endangered (exotics) conservation, particularly Australia and New Zealand
Madonda, M. General Assistant I
Mbense, A. General Assistant II. Machine operator
Mdluli, K. General Assistant I
Mkize, M. General Assistant I
Mncwabe, Ms A. General Assistant I
Mncwabe, P. General Assistant I
Mpangase, Z. General Assistant II
Mpulo, Ms E. General Assistant I
Mthalane, A. General Assistant II
Mthembu, D. General Assistant I
Mtolo, C. General Assistant III. Team leader
Nkabini, A. General Assistant II
Nzakwe, W. General Assistant I
Radebe, A. General Assistant I
Shangase, M. General Assistant II
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Zuma, Ms K. General Assistant I

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Lekheto, M.J. General Assistant III. Building, maintenance
Lekheto, T.S. General Assistant II. Grass garden
Lumley, M.J. Principal Research Technician. Nursery
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Mbolekwa, L.M. General Assistant II. *Rhus*, display
Mofokeng, J.M. General Assistant II. Nursery
Mofokeng, M.S. General Assistant II. Braai area
Mohokare, J. Foreman I. Driver
Mohapi, Mrs M.A. General Assistant II. Bulbs, cleaning
Mohapi, T.A. Gardener. Foreman nursery
Moima, K.H. Foreman I. Foreman garden
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Nakedi, M.J. General Assistant II. Assistant driver
Olifant, M.D. General Assistant II. Kiosk area
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Sebolai, P.R.A.N. General Assistant II. Nursery
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Simoko, M.J. General Assistant II. Glass house, western area
Thaele, Mrs M.E. General Assistant II. Seed room, nursery

PRETORIA NBG

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Baloyi, S.J. Driver/Operator
Baloyi, S.M. Research Assistant
Chipi, S. Security Assistant
Chuma, S.J. Security Assistant
Clarke, Mrs K.P. A.I.C.B.S.A. Research Assistant. Plant recorder
De Ruiter, J. General Assistant III
Hardy, D.S. Chief Research Technician. Nursery supervision, succulents and orchids, conservation of rare and endangered species
Keyter, B.A. Senior Security Officer
Klapwijk, N.A. N.D. (Hort.), N.D. (Plant Prod.), N.D. (Diesel Fitting). First Research Technician. Proteas, fuchsias, southern part of Pretoria garden
Lephera, J. General Assistant II
Letsoalo, H.M. General Assistant I
Mabasa, J.R. Security Assistant
Mabasa, P.P. General Assistant II
Mabunda, Z.S. General Assistant II
Machika, S.M. General Assistant II
Madingwane, J. General Assistant I
Mahlangu, J.J. General Assistant I
Makafula, F. General Assistant I

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Makena, T.J. General Assistant II
Makgopo, C.K. General Assistant II
Makhubela, D. Foreman
Makhubela, K.P. General Assistant II
Makoeng, P.T. General Assistant II
Makola, J. General Assistant I
Makola, L.M. General Assistant III. Tractor driver
Makua, E.G. General Assistant I
Malewa, D. General Assistant II
Malobola, L. General Assistant II
Malobola, M. General Assistant III
Maluleke, M.J. Security
Mametja, A. General Assistant II
Mariri, N.J. Factotum
Marule, P.M. General Assistant III. Tractor driver
Masango, M.G. General Assistant II
Masokwameng, T.P. General Assistant II
Mathabathe, D.S. General Assistant II
Matlala, S.M. General Assistant II
Matshika, S.P. General Assistant II
Mnyangeni, L.D. General Assistant II
Mogoru, M.F. General Assistant II
Mogoru, S. General Assistant II
Mohale, F.R. Foreman
Mohale, J.N. General Assistant I
Mokawe, N.R. General Assistant I
Molefe, J.R. General Assistant III
Molomo, S.E. General Assistant I
Mononyane, J.B. General Assistant II
Morifi, L.J. General Assistant I
Motshweni, V. General Assistant II
Msisa, S.K. General Assistant II
Mudau, R.T. General Assistant I
Muhali, B. General Assistant II
Nkambule, J. General Assistant I
Nkoane, J.M. General Assistant I
Nkwana, F.N. Driver/Operator
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Ramatsetse, P.M. Security Assistant
Rampopana, A.M. General Assistant I
Sete, L. Foreman
Shirindi, J.R. General Assistant I
Shilubane, E. Storeman Assistant
Sithole, J. General Assistant I
Steenkamp, L.C. Plaasvoorman
Strydom, D.J.F. N.T.C. III (Hort.), N.D. (Parks & Rec. Management). Chief Research Technician. Cultivation of mass plants, northern part of Pretoria garden
Tefu, P.R. General Assistant II
Tloubatla, J.L. General Assistant I
Tolo, P.K. General Assistant I

WITWATERSRAND NBG—WILROPARK

Chaplin, P.J. NTC Dip. (Hort.). Chief Research Technician

Behr, Miss C.M. B.Sc. Hons. Principal Research Technician. Education and information, phytosociological classification of the Witwatersrand garden
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Mulibana, N.S. General Assistant II. Machine operator
Mmola, Ms B.E. General Assistant I. Cleaner
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Ndwambi, N.W. General Assistant I. Garden
Nedambale, M.P. General Assistant III. Nursery
Nemalili, M.E. Driver
Nemalili, A.S. General Assistant III. Driver
Nekhavhambe, S.P. General Assistant I. Garden
Nemavhulani, M.R. General Assistant I. Storeman
Nenungwi, M.S. General Assistant I. Nursery
Rammela, N.N. General Assistant II. Machine operator
Raphalalani, V.S. General Assistant I. Nursery
Rathuhali, P.W. General Assistant I. Garden
Steel, Miss B.S. N.D. (Nature Conservation), Dip. (Journalism). Research Technician
Tebeile, Ms Z.M. General Assistant II. Clerical assistance
Tshisikule, G.M. General Assistant II. Garden

RESEARCH DIRECTORATE

PRETORIA

Eloff, Prof. J.N. M.Sc. (Chemistry), D.Sc. (Plant Biochemistry). Director: Research

Pienaar, Mrs S. B.A. Hons. Personal Secretary
Saayman, Mrs E.J.L. B.Sc. Hons. Scientific Liaison Officer. Cytotaxonomy

Arnold, T.H. Programme Leader: Data Management
Brink, Mrs E. Curator: Albany Museum Herbarium (Grahamstown)
Donaldson, Dr J.S. Programme Leader: Conservation Biology (Cape Town)
Du Plessis, Mrs H. Head: Research Support Services
Oliver, E.G.H. Curator: Stellenbosch Herbarium (Stellenbosch)
Rourke, Dr J.P. Curator: Compton Herbarium (Cape Town)
Rutherford, Dr M.C. Programme Leader: Stress Ecology (Rondebosch)
Welman, Miss W.G. Acting Curator: National Herbarium
Williams, Ms R. Curator: Natal Herbarium (Durban)

ALBANY MUSEUM HERBARIUM—GRAHAMSTOWN

Brink, Mrs E. B.Sc. Scientific Officer. General taxonomy and botanical information particularly trees and woody plants

Booi, A.D. Herbarium Assistant. General herbarium practice, identification and information
Verwey, Mrs L.M. Provisioning Administration Clerk. General administration, information and curation
Zenzile, J.M. General Assistant

DATA MANAGEMENT—PRETORIA

Arnold, T.H. M.Sc. Assistant Director. Computer application especially in taxonomy

De Wet, Mrs B.C. B.Sc., B.A., H.D.L.S. Datametrician
Evenwel, Mrs E. Scientific Assistant
Harris, Mrs B.J. Scientific Assistant

COMPTON HERBARIUM—CAPE TOWN

Rourke, J.P. Ph.D., F.L.S. Specialist Scientist. Systematics of southern African Proteaceae, Stilbaceae

Cupido, Mrs C. General Assistant
Forster, Mrs S.E. Provisioning Administration Clerk
Holm, Mrs K. Scientific Assistant
Kurzweil, H. Ph.D. Scientist. Systematics of southern African terrestrial orchids
Paterson-Jones, Mrs D.A. (née Snijman). M.Sc. Scientist. Systematics of Amaryllidaceae
Roux, J.P. N.T.C. (Hort.), M.Sc. Scientific Officer. Systematics of Pteridophyta
Steiner, K.E. Ph.D. Scientist. Systematics of Scrophulariaceae and evolutionary interactions between oil-secreting flowers and oil-collecting bees

CONSERVATION BIOLOGY—CAPE TOWN

Donaldson, J.S. M.Sc. (Entomology), Ph.D. (Zoology). Assistant Director. Cycad biology. plant/insect interactions, plant reproductive biology, scientific illustration

Benic, Miss L.M. B.Sc. Hons (Agric.) M.Sc. (Plant Pathology). Scientist. Plant/host-pathogen interactions in indigenous flora
Botha, P.A. N.H.D. (Hort.). Scientific Officer. Tissue culture research
Bowler, Mrs M. General Assistant
Brown, N.A.C. Ph.D. Specialist Scientist. Seed biology research, plant growth regulators
De Lange, J.H. B.Sc. (Hort.), M.Sc. (Plant Physiology), D.Sc. (Agric.). Specialist Scientist. Ecology, tissue culture, horticulture
Jita, Ms G.N. General Assistant
Köhly, Miss N. B.Sc. (Entomology & Microbiology). Scientific Officer. Scientific illustration
Leivers, S. B.Sc. (Microbiology, Plant Virology). Commercial tissue culture
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Picane, Miss S. General Assistant
Rebelo, A.G. Ph.D. (Zoology). Scientist. Conservation biology, biogeography.
Scott, Mrs G. B.Sc. (Pharmacy), M.Sc. Scientific Officer. Plant secondary compounds

NATAL HERBARIUM—DURBAN

Williams, Ms R. B.Sc. Hons, H.D.E. Scientific Officer

Mbonambi, M.B. General Assistant. Gardener
Ngwenya, M.A. Herbarium Assistant. Identification, information
Noble, Mrs H-E. Provisioning Administration Clerk. General administration
Nzimande, S.B. General Assistant
Sikhakhane, T.B. Herbarium Assistant. General herbarium practice

NATIONAL HERBARIUM—PRETORIA

Welman, Miss W.G. M.Sc. Acting Curator. Scientist. Taxonomy of Convolvulaceae—Asteraceae
Glen, H.F. Ph.D. Assistant Curator: information. Scientist. Taxonomy of trees and succulents, especially *Aloe*, also cultivated plants
Jordaan, Mrs M. B.Sc. Assistant Curator: scientific curation of dicotyledons. Scientific Officer. Taxonomy of Celastraceae
Koekemoer, Miss M. M.Sc. Assistant Curator: monocotyledons, cryptogams and fossils. Scientist. Taxonomy of Poaceae and Asteraceae
Weisser, P.J. Ph.D. Assistant Curator: herbarium support services. Scientist. Ecology, dune vegetation, vegetation dynamics and vegetation mapping

Anderson, H.M. Ph.D. Scientist. Palaeobotany, palaeogeography
Anderson, J.M. Ph.D. Specialist Scientist. Palaeobotany, palaeogeography.
Archer, R.H. M.Sc. Scientific Officer. Taxonomy of Celastraceae
Balsinhas, A.A. Scientific Officer. Mozambican phanerogams, food plants and weeds
Brusse, F.A. M.Sc. Scientist. Taxonomy of the southern African Parmeliaceae
Burger, Mrs S.J.C. Scientific Assistant. General herbarium practice
Cloete, Mrs M. Dip. (Typing). Typist
Dreyer, Miss L.L. M.Sc. Scientific Officer. Geraniaceae
Fish, Mrs L. B.Sc. Scientific Officer. Poaceae. Identifications, collecting
Germishuizen, G. M.Sc. Scientist. Plant identifications, taxonomy of Polygonaceae
Glen, Mrs R.P. M.Sc. Scientific Assistant. Algae, ferns
Herman, P.P.J. M.Sc. Scientific Officer. Identifications, Convolvulaceae—Asteraceae, Flora of Transvaal
Heymann, Mrs M.Z. T.E. Dip. Scientific Assistant
Lephaka, M.G. Scientific Assistant. Parceling and pressing
Makgakga, S.K. Scientific Assistant. Mounting and filing of herbarium specimens
Nicholas, A. M.Sc. Scientist. Presently South African Botanical Liaison Officer at the Royal Botanic Gardens, Kew. Taxonomy of the Asclepiadaceae (incl. Periplocaceae), carnivorous plants (particularly the Droseraceae), herbarium pests
Perold, Mrs S.M. M.Sc. Scientific Officer. Taxonomy of Ricciaceae (Hepaticae)
Phahla, T.J. Scientific Assistant. Mounting and filing of herbarium specimens
Pretorius, Mrs. R. B.Sc. Hons, H.E.D. Scientific Assistant
Reid, Miss C. M.Sc. Scientist. Monocotyledons, gymnosperms and ferns. Taxonomy of Cyperaceae
Retief, Miss E. M.Sc. Scientist. Pollen studies of the flowering plants of southern Africa
Strohmaier, Mrs S.M. T.E. Dip. Scientific Assistant
Taussig, Miss J.A. N.D. (Hort.). Scientific Assistant
Van Engelen, Miss C.M. Scientific Assistant (Temporary)
Van Rooy, J. M.Sc. Scientist. Taxonomy and biogeography of mosses
Van Wyk, Mrs C.M. M.Sc. Scientist. *Melolobium, Pelargonium*
Veldman, Mrs J.M. Provisioning Administration Clerk

STELLENBOSCH HERBARIUM

Oliver, E.G.H. M.Sc. Curator. Scientist. Taxonomy of the Ericoideae (Ericaceae)

Beyers, Mrs J.B.P. B.Sc. Hons. Scientist. Taxonomy of the Gnidieae (Thymelaeaceae)
Davidse, Mrs E. Scientific Assistant
Fellingham, Mrs A.C. B.Sc. Scientific Officer. Taxonomy of *Cliffortia* (Rosaceae)
Leith. Mrs J. Provisioning Administration Clerk

STRESS ECOLOGY—RONDEBOSCH

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Knight, A.H. Scientific Assistant
Lewis, Mrs E.W. Senior Provisioning Administration Clerk
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Midgley, G.F. M.Sc. Scientist. Plant stress physiology/ecology
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Pickett, Ms G.A. B.Sc. Hons. Scientific Officer. Vegetation dynamics
Powrie, L.W. M.Sc. Scientist. Karoo ecology, education, computer programming/operations

RESEARCH SUPPORT SERVICES—PRETORIA

Du Plessis, Mrs H. B.Sc. Hons. Head of Cost Centre. Scientist. Cytogenetics

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Roux, Mrs W.J.G. Dip. (Private Secretary). Scientific Assistant. Graphic artist, biology
Steyn, Miss C.C. Scientific Assistant. Embryology

PUBLICATIONS BY THE STAFF
(1990-04-01—1991-03-31)

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Book Reviews

FLORA OF SOUTH-EASTERN QUEENSLAND VOL. II by T.D. STANLEY and E.M. ROSS. 1986. *Queensland Department of Primary Industries*, Miscellaneous Publications 81020, G.P.O. Box 46, Brisbane 4001, Australia. Pp. 623, 84 plates. Price hard cover: $40.

Great national floras are invariably over-ambitious projects which, launched from the shores of good intentions, tend to proceed at a snail's pace and can count themselves lucky if they are not stranded on the shoals of indifference or wrecked on the reefs of financial stringency long before they arrive anywhere remotely approaching their final destination. On the other hand, regional and local floras seem to have come into their own, as well they might, for they have a good chance of being completed within a reasonable period of time, are of immediate relevance to a specific group of local users and usually enumerate a managable number of species. They also do not suffer from the expectation of providing 'definitive' or 'complete' taxonomies in the way more wide-ranging or grandiose floras tend to.

Stanley and Ross's *Flora of South-eastern Queensland* is an excellent example of an honest, thoroughly workable, unpretentious, yet high-quality volume, enumerating the flora of about one tenth of the state of Queensland on the eastern shores of Australia. It thus provides a working flora for an area surrounding the state's most populous city, Brisbane. This volume (no. 2 in series of 3) covers the families Celastraceae to Asteraceae and also includes the Proteaceae carried over from Vol. I so as to reflect changes made in recent revisions. It treats 1 347 native and naturalised species of dicotyledons not covered in Vol. I and includes the important genus *Eucalyptus*, represented by 91 species.

I could not help noticing how many South African plants have become naturalised in Queensland; especially in the Asteraceae: *Arctotheca calendula*, an *Arctotis* listed as *A. stoechadifolia* (which it probably is not), a *Gazania* and also *Chrysanthemoides monilifera*—a declared noxious weed in that part of the world. Surprisingly, *Orbea variegata* —listed under its old name *Stapelia variegata*, is also naturalised in some parts of the state.

Bracket keys to both genera and species are used throughout. Those I randomly tested use very clear unambiguous contrasting characters. Each species entry commences with a currently accepted binomial plus author citation and a brief synonymy where relevant, but there are no literature references apart from a couple of instances where major works are referred to. A description (short and diagnostic) followed by comments on distribution and habitat comprise each entry. Taxa recognised as being distinct but for which no current name could be found are listed as 'species 1', 'species 2' etc.—an honest and very pragmatic approach.

As a further aid to identification there are 84 mostly full page composite plates of excellent line drawings depicting the diagnostic characters of a surprisingly wide range of species. Indexes to scientific and common names complete the text.

This sturdy, well-bound publication with a crisp clean typeface seems to meet all the requirements of local flora among the botanical community. However, it did seem to me perverse that the authors chose to arrange the families in Englerian sequence when the *Flora of Australia* (as they must well have known), uses Cronquist's system. From a user's point of view would it not be easier if regional floras followed the system of the National Flora? Perhaps there were good reasons in this case but I would have thought standardisation would be preferable.

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GERMINATION PHYSIOLOGY AND DESERT ECOLOGY, guest edited by A.M. MAYER and G. ORSHAN. 1990. Special issue of the *Israel Journal of Botany* Vol. 39, Nos 4–6: 291–518. Size 240 × 165 × 13 mm. *The Weizmann Science Press*, P.O.B. 801, Jerusalem 91007, Israel. Price: institutional, $38.50; personal, $27.50.

This special issue of the *Israel Journal of Botany* has been dedicated to the memory of Michael Evanari, who, from substantial grounding in Germany as Walter Schwarz, became one of the foremost ecophysiologists of arid regions under his new name in Palestine/Israel. The editors of the volume have gathered together an interesting variety of six papers on germination physiology and ten on desert ecology in the widest sense. There is no other unifying theme and I will briefly convey my impressions of most of the papers in the sequence given.

The first paper relates Evanari's special contribution to research on germination over a period of almost 50 years where he accelerated the realization that no single mechanism regulates germination, also in the desert environment. Other germination papers consider associated ultrastructural changes in *Echinochloa crusgalli*, regulation by ethylene in *Helianthus annuus*, redesiccation effects in *Lactuca sativa*, gibberellic acid responses in *Kalanchoë blossfeldiana*, and water relations and oxygen uptake in *Zea mays*. In another paper, Gutterman asks whether germination mechanisms differ in plants originating in deserts receiving winter or summer rain. Using species of Mesembryanthemaceae, originating from the arid climatic areas of South Africa receiving winter or summer rains, the study is inconclusive and a plea is made for more research on the possible importance of thermo-inhibition as a survival mechanism in arid habitats.

Survival of the winter annual desert plant, *Anastatica hiërochuntica* in its natural environment is not as affected by water shortage as by high salinity and phosphate and nitrogen deficiency, according to work from a Würzburg-Bayreuth research group (with Detlev Schulze). They also indicate the potential importance of plant hormones in the soil based on presence of ABA found in the soil water. A clear ABA increase of up to 25-fold in the xylem sap was found when a stress threshold of water potential reached −0.8MPa.

Using plant growth rate projections, Otto Lange suggests that one of the oldest organisms in the Negev Desert at Avdat is the thallus of the crustose epilithic lichen, *Caloplaca aurantia* which is estimated to be 500 years old. Interestingly, it appears that the metabolism of the Negev lichens shows growth rates similar to those of species from such climatic regions as the temperate and alpine zone which seem to be more suited for poikilohydric organisms.

In a fascinating extension of the highly original finding of hydraulic lift by Richards & Caldwell in 1987, Martyn Caldwell tested for parasitism of water released from neighbouring plants after night efflux of water from the root system into dry soil layers. Although results for a shrub-grass tussock mixture were negative, the concept could profitably be tested using different combinations under many other conditions.

A novel experimental approach to understanding competition between desert annuals is described by Kadmon & Shmida. Although confirming the expected minimal effect of competition on seedling survival, competitive effects were found to be critical in determining fecundity of individuals studied. This flatly contradicts some of the interpretations of the 'autecological hypothesis' in desert ecosystems.

Imanuel Noy-Meier shows how results from grazing exclusion plots in semi-arid rangeland deviate from model predictions and how growth form composition may help explain differences.

Mary Seely documents the aftermath of an exceptional heavy rainfall in the special dune sea of the Namib Desert. She found that although both the grass, *Stipagrostis sabulicola*, and the succulent, *Trianthema hereroensis*, germinated well over most of the bare dune sand, only 11% of the grasses and none of the succulents had survived 11 years later. This is attributed not only to moisture limitations but to sand mobility effects.

A chapter on the 'myth of chaparral convergence' is a useful overview but possibly over-extends the term chaparral and gives short shift to the wealth of relevant published works on fynbos ecosystems of South Africa.

A rather ambitious attempt is presented, in the penultimate paper, to relate species richness of plant communities to component growth rates and system driving forces. I believe that, at very least, a wide range of testing of the proposed models is needed before scale dependence and systems generality may be assessed.

Henri Houérou provides a projection of global climatic change effects versus land-use effects in the southern Mediterranean Basin. He concludes that at the regional scale, change during the next 60 years will be influenced far more by the exponential human demographic growth than by the possible temperature increase.

I have enjoyed reading this varied volume which contains several simple yet stimulating and thought-provoking concepts and approaches. If your library does not subscribe to the *Israel Journal of Botany* and you have a special interest in the functioning of organisms and ecosystems in arid zones (especially Mediterranean-types), I can recommend the separate purchase of this special volume.

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